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MONTANA OUTDOORS

SHIRLEY CLEARY

MONTANA OUTDOORS

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Front Cover
The beleaguered Clark Fork is a river whose time has come, and many people are working hard to assure the Clark Fork legacy. A vital part of that legacy is the opportunity for "Playing a Fish," as Shirley Cleary's painting so appropriately illustrates.

Inside Front Cover
The trestles still visible at Sluice Boxes State Monument are a reminder of an earlier time, a time when the "Iron Horse" played a critical role in carrying ore to smelters. Mike Gurnett's photo is a suitable introduction to a natural area offering visitors the chance to relive a bit of Old West history.

Back Cover
The theme for this year's celebration of National Wildlife Week (March 17-23) is: "Soil—We can't grow without it."

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I have always been amazed by the attention wildlife receives in Montana, after having grown up in New York state. Talk of wildlife during the hunting season seems universal. But here in Montana, it would be unusual to pick up a newspaper or listen to a local newscast any time during the year without hearing about some wildlife-related issue.

Montana's interest in wildlife is likely a result of the high degree of participation by its residents in wildlife-related recreation. According to a recent survey, few states can boast of a higher percentage of their residents involved with hunting (35%) or fishing (60%). The percentage of Montanans hunting represents three times the national average, and over 10 times what occurs in California. Perhaps it's because there are so few Montanans and because the state is so large that residents feel a duty to be involved in resource issues, particularly those concerning the future of their land and wildlife.

An excellent example of citizen participation is the history of management in the Elkhorn Mountains south of Helena. Issues related to management of this area have been in the news for over 20 years; directly or indirectly, they have nearly always involved wildlife. The Elkhorn Mountains have traditionally been intensively utilized for outdoor recreation, mostly oriented toward enjoyment of the area's abundant wildlife.

The unrelenting public interest in the fate of this mountain range has led to the U.S. Forest Service (USFS) decision to emphasize wildlife as the primary resource management value in this area. The Helena and Deerlodge National forests released draft forest-wide plans earlier this year describing how these forests are going to be managed in the future. Included is specific direction for the Elkhorns recognizing the significant wildlife resource of the area, while managing other land uses consistent with the wildlife needs. The main objectives are to optimize opportunities for public recreational use of wildlife and to maintain and enhance wildlife values through integrated land-use and wildlife management strategies.

The decision by the USFS to manage an area as large as the Elkhorns specifically for wildlife is unprecedented. National forest land is typically managed either as wilderness (restrictive in permitted activities) or multiple use, where, in any particular area, several resources (timber harvesting, mining, livestock grazing, wildlife) may be emphasized. Establishment of the Elkhorns Wildlife Management Unit is one of only a very few examples nationally where the USFS has administratively designated an area to maintain or enhance specific attributes. Examples of other administative designations include the Kirtland's Warbler Habitat in Michigan and the Copper River Delta in Alaska. Land-use management in the Elkhorns represents a progressive attitude by the USFS aimed at specific objectives for the area's wildlife resources. The agency has worked closely with the Montana Department of Fish, Wildlife and Parks, and has responded to concerns expressed by the public.

The Elkhorn Range

The Elkhorn Mountains are characteristic of isolated ranges east of the Continental Divide. The range is 21 miles long, 19 miles wide, and it encompasses the area between Helena, Townsend, and Boulder. The Elkhorns include over 200,000 acres, of which 90% is in public ownership; 160,000 acres is included in the USFS' Wildlife Management Unit. Geography has played a major role in the popularity of the Elkhorns and its long history of public interest. The mountain range is accessible from all directions, and it is less than an hour's drive from Butte, Bozeman, or Helena.

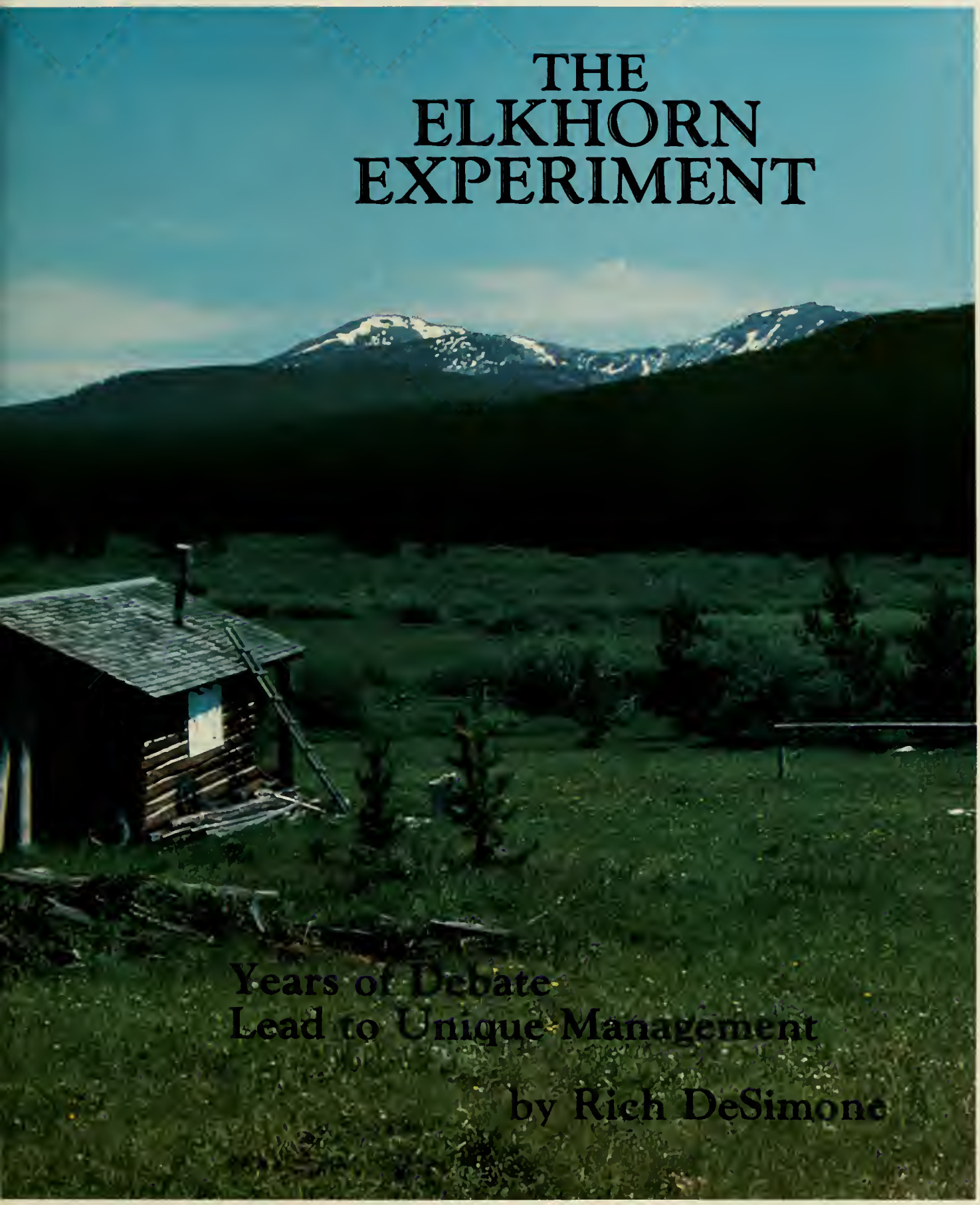
The Elkhorns have diverse climate, soils, geology, and topography that produce a complex of habitats that support a variety of plants and animals. The mountain range offers a mosaic of lower slope grasslands, expanses of timber, barren alpine peaks, cirque basins, and mountain meadows. The several-thousand-acre Tizer Basin, in the center of the mountain range, is popular because of its clear mountain streams and lakes, scenic beauty, pristine environment, and abundant wildlife.

Today's aesthetic qualities of the Elkhorns contrast sharply with the highly explosive activities which occurred near the turn of the century. Extensive mining, livestock grazing,

BILL SCHNEIDER

The Elkhorns provide diverse hunti

THE ELKHORN EXPERIMENT

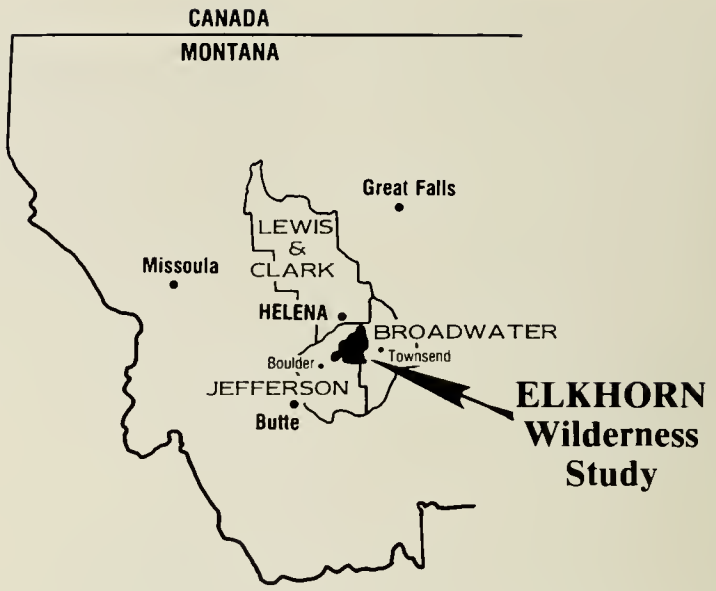


Years of Debate Lead to Unique Management

by Rich DeSimone

pportunities; many portions are roaded, but other portions, such as the Tizer Basin (above), provide a back country experience.

uncontrolled hunting, and timber removal virtually denuded the area's timber and range, ruined the water quality, and depleted the wildlife. Reminders of this history are the ghost towns of Elkhorn, Ruddville, and Hassel. With creation of the USFS in 1905, controls were gradually imposed, and the land began to slowly recover. Today, the area supports a diversity of carefully managed activities including livestock grazing, several small mining ventures, limited timber removal, and an array of outdoor recreation opportunities.



The Elkhorns' Wildlife

The Elkhorns are particularly special because they maintain an abundance and variety of wildlife, including eight of Montana's big game species. Black bears, white-tailed deer, pronghorns, and mountain lions are commonly hunted in the area, although the species receiving the majority of public attention are mule deer, mountain goats, moose, and—especially—elk.

Mule deer, found throughout the range, are experiencing the same population high as elsewhere in the state.

Mountain goats were transplanted into the Elkhorns between 1956 and 1958. They inhabit primarily the Elkhorn Peak/Crow Peak area, but can also be observed in the Tizer Basin, the Crazy Peak/High Peak area, and in the Beaver Creek drainage. Mountain goats have been hunted since 1974, with five permits allowed per year. Most public interest in mountain goats, however, centers simply on being able to find and watch these fascinating animals.

Moose occur primarily in the western and southern portions of the mountain range. They have been hunted since 1965, and the number of permits has varied from five either-sex, to three bulls (the current quota). Although moose are not abundant, they are usually more easily seen than elk, and many people seem to have their own favorite story about an encounter with these huge, strange beasts.

The Elkhorns have traditionally been one of Montana's most popular and productive elk hunting areas. The mountain range ranks among the highest per unit area in terms of number of bull elk harvested, number of hunters, and the number of hunter recreation days. These exceptionally high elk values are a result of the closeness of the area to several population centers, the inherent ability of the land to support healthy and productive herds, and the diversity of hunting opportunity available to sportsmen.

It is fortunate that most of the elk winter range in the Elkhorns occurs on public land—70% to 80% of the elk winter on national forest land. This contrasts sharply with most elk ranges in Montana, where national forest land is used mostly for summer range, while private and department-owned land provides the bulk of the winter range. Public ownership of most of the elk range provides a rare opportunity for improving habitat conditions and maintaining, or enhancing, elk populations without burdening adjacent landowners. In portions of the Elkhorns where elk winter on private land, the objective is to improve conditions on national forest land and develop harvest strategies to encourage use of public land by elk, and thus reduce elk numbers on private land.

An important feature of the Elkhorns is the diversity of hunting opportunity. Many portions are roaded, so hunting is not contingent on a camp or pack stock, and harvested game can be easily retrieved. Examples of these areas include lower Crow Creek, and the north and south ends of the mountain range. Other areas of the range have either primitive or no roads, such as the Tizer Basin, upper Beaver Creek, and upper McClellan Creek. In these areas, a backcountry hunting experience is available. Five licensed outfitters operate in the Elkhorns, although many people hunt the backcountry and pack or carry in provisions themselves. In Montana, it appears that areas like the Elkhorns, which offer diverse hunting experiences, also rank among the highest in hunter use.

History of Issues

The Elkhorns have been the center of an intense land-use debate, which gained momentum in the mid-1960s. Concerns focused on effects of livestock grazing on public elk winter range in the lower Crow Creek drainage. This controversy prompted some of the first research done in Montana concerning the interrelationships between domestic livestock and elk. The work revealed no significant problems, although grazing systems, stocking rates, and scheduling were modified to reduce the potential for conflict. Interest in the Elkhorns continued to grow in the late 1960s and early '70s as the timber harvest and road building progressed into Hog Hollow, Staubach, North Pole, Hall, and Bear creeks.

The National Forest Unit planning process was in its early stages at the beginning of the 1970s, and the resulting multiple-use plan on the Helena National Forest provided management direction for the

LOUIS M. KIS

Eight of Montana's big game species inhabit the Elkhorns. Moose occur primarily in the western and southern portions of the range.

southern portion of the Elkhorn Mountains. The final Elkhorn Unit Plan was released in 1976. This plan recognized the area's high wildlife values, and placed some emphasis on elk; however, it also specified continued logging and road building. In fact, the plan directed timber harvest all the way into Tizer Basin and proposed a transmountain road which would have connected Townsend with Jefferson City—and, in doing so, would have bisected the mountain range.

When the Elkhorn Unit Plan was released, certain segments of the public were outraged, particularly at the possible consequences to wildlife and roadless values (see "The Elkhorns," *Montana Outdoors*, Nov./Dec. 1976). Debate over the issues resulted in many public meetings concerning the plan. On Labor Day, 1976, Congressman John Melcher conducted a Congressional hearing in Helena about the Elkhorn controversy. Strong public sentiment to protect the Elkhorns resulted in legislation specifying a study of the Elkhorns for possible inclusion in the Wilderness Preservation System.

The draft Elkhorn Wilderness Study Report was released in 1978, and called for 25,000 acres of wilderness in and around the High Peak/Crazy Peak/Casey Peak areas, and included recognition of the wildlife values of the area.

Again, public response was substantial; although public reaction was mixed to the question of wilderness, an almost unanimous consensus emerged to protect and manage the area's abundant wildlife resources—even among those not favoring wilderness designation.

The final Elkhorn Wilderness Study Report, released in 1981, recommended no wilderness, but instead provided specific criteria to be followed in developing the "Elkhorn Wildlife Management Unit." The management unit would emphasize wildlife; other activities would be allowed only if compatible with the area's wildlife values.

The department has always had a special interest in the Elkhorns. In 1980, a department biologist was assigned to the Helena National Forest to assist in developing specific guidelines for managing each resource in the Elkhorns. These guidelines are included in the Forest Plans of the Helena and Deerlodge National forests. (This new land management planning process was a result of the National Forest Management Act of 1976 which directed each national forest to prepare an integrated Forest Plan describing long-term management for all resources.)

The department has maintained close association with the USFS in managing the Elkhorns. In fact, the 1983 Montana Legislature directed funding specifically for the department to continue the cooperative effort. This partnership in management has been considered a model of state/federal cooperation, and has done much to promote a better understanding of each agency's functions, responsibilities, and problems.

Management of Elkhorn Resources

Managing a mountain range as large and complex as the Elkhorns is a considerable task. The area is administered by two national forests, including three ranger districts, the Bureau of Land Management, the

BILL SCHNEIDER

state of Montana, and over 100 landowners controlling several thousand acres. Demands for all natural resources continue to accelerate, so devising a plan that is responsive to the needs of the public, while emphasizing wildlife, has been a considerable challenge. Constant contact with environmental, industrial, agricultural, landowner, and sportsmen groups is necessary.

Specific management of resources in the Elkhorns will include directions for range, timber, minerals, wildlife, and access. Livestock grazing has traditionally been a major land use. In fact, this area represents only 15% of the land in the Helena National Forest, but supports almost 25% of the forest's total livestock grazing. The objective is to maintain livestock grazing at current levels. Available information does not reveal any major problems between livestock and wildlife. As we learn more about this relationship, there may be opportunities to improve range conditions through modifications of grazing systems and practices.

Timber management has long been a sensitive issue. Timber harvest is not planned in the Elkhorns on a programmed basis, but only as a management tool to maintain or improve wildlife habitat. Our present understanding does indicate opportunities to use timber management to maintain or improve wildlife habitat, particularly in roaded areas not receiving much wildlife use. Opportunities to cut Christmas trees, firewood, and post poles are still available, using existing roads.

Management of roads is another subject which generates lively discussion. The plan is to maintain current access, unless evidence indicates major conflicts with wildlife. Restrictions in effect over the years have protected winter range and provided non-motorized recreation. The current travel situation provides conditions ranging from easy access, to semi-primitive, and unroaded.

Opportunities to influence private land and mining activities, while

STEVE GILBERT

maintaining wildlife values, are limited in comparison with control of other actions. Experience in the Elkhorns, however, has shown that working with developers can often result in compromises, allowing the development to take place, and yet maintaining surrounding wildlife values.

Wildlife Monitoring Program

The way in which wildlife uses the Elkhorn Mountains is an integral part of the management program. The department and USFS initiated a jointly funded wildlife monitoring program in 1982 to study wildlife populations, wildlife habitat, and land-use activities. This effort has focused on how past, present, and future activities of man are affecting elk; what changes in those activities are necessary to maintain elk values; and what modifications can be made to improve elk habitat.

RICH DESIMONE

Less than an hour's drive from Butte, Bozeman, or Helena, the Elkhorn Mountains are heavily used by outdoor recreationists. A popular and productive elk hunting area, the Elkhorns are now managed by the U.S. Forest Service primarily for wildlife values. Monitoring elk through radio telemetry (above) is providing valuable information on elk ecology.

Radiotelemetry is being used to study elk ecology. During the last three winters, 82 elk have been captured and marked; 77 of these have been fitted with a plastic collar containing a radio transmitter.

Monitoring elk throughout the year has provided information about the use of seasonal ranges, including the location, timing, and amount of use. Elk ranges include winter, spring, calving, summer, and rutting ranges, and areas used during, and because of, hunting seasons. Aerial surveys are flown several times during the year to inventory elk numbers, calf production, and calf survival during various seasons.

An important finding of the monitoring program is that there is not simply one large herd of elk in the Elkhorns, but numerous, relatively autonomous, population segments. These segments use specific seasonal ranges, and interact little with other segments. This information is critical to interpreting the effects of local habitat conditions and land-management activities on a particular population segment. Comparison of vigor between population segments may then be traced to local habitat conditions and human activities. This, in turn, may result in management modifications to improve wildlife habitat.

We are applying our knowledge of elk to evaluate prescribed fire treatment of cattle (and big game) range, to determine whether the quality and quantity of elk winter forage is improved. Effects of this burning can be determined by measuring the response of a particular elk population segment in terms of the rise or fall of total numbers, or changes in production and survival of young over time. Another aspect of the work involves composition and quality of elk diets. Comparing diet information of a given elk segment before and after a burn, and in relation to diets of other population segments, provides a way in which to measure benefits to elk.

The wildlife monitoring program is also evaluating the influences of livestock grazing on elk, and the possibility of using cattle to enhance elk forage in some areas. In another area of the Elkhorns, the response of elk to road management is being measured, particularly with respect to changes in elk harvest as a result of changes in hunter access.

During 1984, the monitoring program focused attention specifically on bull elk. Little is known about seasonal use of various habitats by young and older bulls. Information is needed about the way in which different types of hunting seasons influence hunter attitudes, and how these seasons affect survival of bull elk from one year to the next. Information from 21 recently radio-equipped bull elk is now beginning to help unravel some of the mysteries of how bulls use the mountain range and are affected by hunting seasons.

This monitoring effort is a learning process to determine how to best manage elk and elk habitat. Since much of what we learn in the Elkhorns will be applicable to elk habitat throughout Montana, the result will be better elk management on national forest land.

To a large extent, the future of many wildlife species will be dictated by future management of national forest lands. Managing the Elkhorn Mountains specifically for wildlife is a creative example of land management responsive to public concerns. The importance of these lands to Montana's wildlife cannot be overemphasized. Over 80% of the state's elk and moose harvest and over 95% of the bighorn sheep and mountain goat harvest comes from federal lands, while the 10 national forests in Montana account for only 18% of the state's land area.

This relationship between wildlife and federal land signifies the need for state wildlife managers and federal land managers to work together, and the Elkhorns project demonstrates that a productive federal/state relationship can be achieved. The Elkhorn Mountains' wildlife values are secure due to USFS and department commitment to long-term monitoring of man's effects on wildlife. ■

Back From The "Iron

by Mike Gurnett

As you travel around Montana, you constantly find yourself face to face with pieces of "Old West" history. You stop to admire a vista, only to find out later that it already had found its way to Charlie Russell's canvas. You travel one of Montana's many rivers or streams, only to find the watery pathway mentioned in the journals of Lewis and Clark. Some areas hide their past well—faint pictographs on cave

NELS THORESON

walls, or tipi rings camouflaged by heavy vegetation. Other ruins are slow to be consumed—one can easily see reminders of the homestead, the mine, or the mining camp. Often, one does not think twice about many of these places. But if you allow that second thought, chances are that a rich accounting of yesterdays awaits.

One such place lies concealed on Belt Creek in the Little Belt Mountains, between the mouth of Logging Creek and the early-day settlement of Riceville. Known as the Sluice Boxes State Monument, the "Sluice Boxes" actually refers to a 1½-mile inner gorge of Belt Creek Canyon. Here, as in many other drainages of the Little Belt Mountains, water has dissected the limestone, leaving sheer cliffs that make the area seemingly impassable.

MIKE GURNETT

On Oct. 23, 1879, E.A. "Buck" Barker and Patrick Hughes came over the divide from Yogo Creek to hunt upstream from the Sluice Boxes in a drainage known as the Dry Fork of Belt Creek. On that trip, they discovered a rich silver and lead deposit which resulted in the founding of the Barker Mine. Word of their discovery traveled fast. Within the next year, a hundred men were working the area. The boom was on.

At first, the high-grade ore was hauled cross-country, avoiding the Sluice Boxes, to Fort Benton. It was then shipped to a smelter down river. Because it was difficult to transport the ore through the rugged terrain, smelters to refine the pay load were soon built nearer the mine. Col. George Clemdennin built one such smelter, consisting of a water-jacketed furnace which produced $370,000 worth of bullion in the first 18 months. Clemdennin was killed in a mining accident, and his smelter produced little after that.

At the time of Clemdennin's death, the supply of high-grade ore had been exhausted, and deeper exploration in

Horse"

the mine uncovered a lower grade ore. The Dry Fork mining activities could easily have been abandoned if it had not been for another event in the Montana Territory: the advent of the "Iron Horse."

James Hill, a Minneapolis railroad magnate, was laying track throughout the West. His enterprises would later become known as the Great Northern (and ultimately the Burlington Northern) Railroad. When Hill began his operations in Montana, he asked Col. Charles Broadwater to represent him at an organizational meeting of the Montana Central Railroad. Broadwater, who was named the first president of the Montana Central, had gained experience as a part of the "Diamond R" overland freight line (the "Diamond R" was often depicted in Charlie Russell's paintings). Under Broadwater's supervision, the Montana Central was constructed; it carried ore from Butte via Helena to a new silver smelter at Great Falls built by that city's founding father, Paris Gibson. Spurs were built from the main line to the mining camps of Rimini and Marysville near Helena, and the Belt Mountain Branch went to Neihart.

To run the Belt Mountain Branch from the smelter in Great Falls to the Barker Mine meant that Broadwater had to face the difficult Sluice Boxes of Belt Creek. As if that weren't enough, he found that if the creek wasn't encased by vertical limestone walls, it meandered from one side of the valley to the other. By the time Broadwater reached Neihart in 1891, he had engineered trestles that criss-crossed Belt Creek and its side channels some 40 times. He elected to keep the railroad on the west side of the Sluice Boxes; by using stone masonry, he literally built the railroad bed into the cliff.

At the same time Broadwater was busy conquering obstacles along Belt Creek Canyon, T.C. Power, famous for his Missouri River steamboats, brought his "Block P" to the Dry Fork (the "Block P" had long been displayed between the stakes of his steamers). After acquiring many important mining claims, he named the company and the mine group the "Block P." By no accident, Gibson was with Power when the Barker Mine was acquired in 1892. Gibson was eager to develop new sources of ore for his recently constructed smelter. With the backing of these early-day industrial giants, the Belt Creek area was once again a hub of activity.

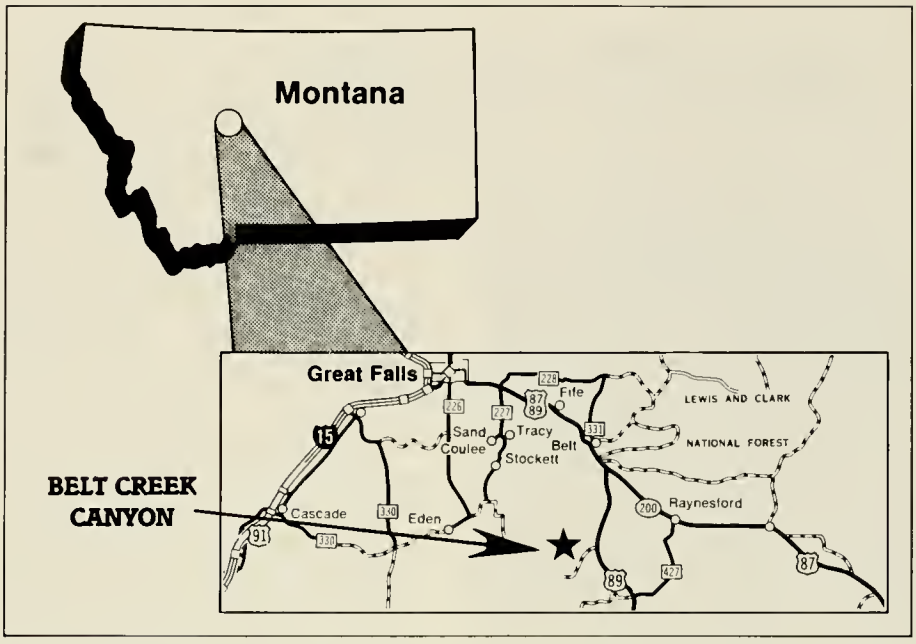
By 1913, the railroad, now known as the Great Northern, helped to spotlight the recreational potential of the Belt Creek area. On weekends, Great Falls residents could climb "all aboard" and ride up to their favorite fishing hole. Others continued on to Neihart for an afternoon of baseball. On the return trip, the engineer stopped to pick up the fishermen.

Nels Thoreson, recently retired Department of Fish, Wildlife and Parks supervisor for the Great Falls region, has lived most of his life in the Belt Creek area. Thoreson said when he was young, the locals didn't wait for the weekend to roll around to take advantage of the recreational train. They hitched a ride on the "Speeder" (an engine and flatcar used for repairs on the line) and rode to their favorite fishing spot in no time at all. As Thoreson told me this story, it all seemed to come together best if thought of as a Norman Rockwell cover—kids with cane poles leaping from the flatcar, and a collie-cross, mouth wide open, at their heels.

But then, nostalgia seems to be in

Exploring the remains of a railroad line and fishing a clear mountain stream are among the many activities that await a visitor to the scenic "Sluice Boxes" of Belt Creek.

NELS THORESON



the nature of the Sluice Boxes. Even though the land looks much the same as it did when Buck Barker went hunting up the Dry Fork in 1879, there is just enough left of the railroad bed and the trestles to remind you that you are far from the first to visit this place.

The mines shut down in 1943, and the last train to Neihart was soon to follow. The railroad right-of-way reverted to the Montana Department of Highways. Because of its interest in the limestone deposits, the Anaconda Copper and Mining Co. (ACM) had earlier acquired 1,070 acres that bordered the right-of-way between Logging Creek and Riceville. Through a land trade with ACM in 1970, and a lease agreement with the Highway Department in 1971, the Department of Fish and Game began managing the site under the name Belt Creek Natural Area. In 1976, the Montana Fish and Game Commission voted to change the name to the Sluice Boxes State Monument. Subsequent land purchases and exchanges have brought the total area managed to 1,235.39 acres.

Sluice Boxes State Monument is managed as a natural area. It is not a place to visit expecting to find a completely developed facility, although a parking area is maintained on the banks of Belt Creek near Riceville. A parking area is also provided on the west side for those who choose to hike down to the gorge. In lieu of developed campgrounds and trails, you are on your own to fish for trout, hike along the ruins of the railroad line, and have the opportunity to observe many species of game and nongame wildlife.

For those who are so inclined, the area offers the chance to pay tribute to the land and to the people who first settled there: to the perseverance of Power, Gibson, and Broadwater who saw no obstacle too great; to a time not long ago when the area was first used for recreation; to the engineer of the "Speeder"; to changing times, the "Iron Horse," and the role it played in taming Montana. ■

BOOK REVIEWS

WATERFOWL DECOYS OF MICHIGAN AND THE LAKE ST. CLAIR REGION, by Clune Walsh Jr. and Lowell Jackson, Gale Graphics, Book Tower; Detroit, MI 48226; 1983, 175 pages, $40, hard cover.

Beautifully designed, the interesting text and photos of the Michigan decoy book are extremely helpful to the hunter interested in history and the "tools of the trade."

Michigan decoys in Montana? Of course. The products of the famous decoy factories of Detroit—Peterson, 1873; Dodge, 1884; and Mason, 1894-1924—found their way to Montana. Through the years, I've seen many Michigan decoys in homes, at antique sales and flea markets, and in collections. One I picked up in Great Falls was identified as an Ed "One Arm" Kellie of Monroe, Mich. Mr. Kellie's handicap is not reflected in his beautiful bluebills and canvasbacks.

While decoys are not common in the Big Sky country, the lore of the decoy and the search for examples of the carver's art make an interesting pastime when not hunting the real thing.

From huge diving duck blocks weighing several pounds to super-hollow decoys that tip the scales in ounces, "Waterfowl Decoys" provides insight into the wide variety of decoys and the hunters who made them.—*Roger Fliger, Region 5 (Billings) supervisor*

THE ENCHANTED BROCCOLI FOREST, by Mollie Katzen, Ten Speed Press, Box 7123; Berkeley, CA 94707; 307 pages, $11.95 plus 50 cents postage, paper.

If you're thinking the title of this cookbook suggests nothing to do with game and fish cookery, you're absolutely right. So why review it in our magazine? The answer comes from author Mollie Katzen's introduction: "The common trait linking all these recipes is their meatlessness. Yet, this book is by no means an exclusive message for vegetarians. Meat-eaters can use these recipes, too—for occasional meatless meals or as accompaniments to meat dishes. The vegetarian aspect of this cookbook is not intended to promote any style of living over any other. Rather, its purpose is merely to provide more options for enjoyable eating."

This cookbook is a follow-up to "The Moosewood Cookbook" (reviewed in *Montana Outdoors,* March/April 1981, page 12). Like her first cookbook, Katzen features wholesome, natural foods prepared in delicious ways. The cookbook is organized into six chapters: soups, salads, breads, entrees, light meals for nibblers, and desserts.

And now for some tempting recipe titles (if these don't convince you to buy the book, probably nothing will): potato, cheese, and chili soup; marinated pasta salad; apple and cheddar soufflé; cranberry brown bread; avocado-cashew enchiladas; pasta with marinated artichoke hearts; coconut-almond macaroon torte; and ricotta-cherry mousse.

Whimsically illustrated and hand-lettered by the author, it's a delightful cookbook to have on your shelf.—*Donita Sexton, art director*

THE CATCHALL

Travel On, But Leave A Name Behind by James J. Jonkel

Waldbillig Mountain sits high on the Swan Range divide in northwestern Montana, along the west side of the Bob Marshall Wilderness. From the horn of the mountain, large armlike ridges radiate outward to encompass the high mountain cirques that form the headwaters of the many tributaries in the beautiful Flathead Valley.

In the late summer of 1906 at the base of Pendant Creek, which is fed by the snow fields of the mountain, an early-day game warden by the name of Waldbillig attempted to arrest a small hunting party of Flathead Indians who had violated various game laws. During the process an argument broke out, and the game warden was murdered. The Indians left the scene of the crime, never to be heard of again, and the body of Waldbillig was later found and packed out by another warden from Ovando.

Throughout western Montana there are countless drainages, lakes, and mountain peaks with interesting and uncommon names. This article describes the events responsible for the names of some landmarks in the Bob Marshall and Great Bear Wilderness areas.

The town of McCarthyville thrived from 1890 to 1892. It was a rough railroad boom town situated just below Marias Pass on Deer Creek, a tributary of the Middle Fork of the Flathead River. The town was founded by Eugene McCarthy, an enterprising young man who had heard rumors of the new railroad and then had proceeded to file a Declaration of Occupancy on the only flat spot in the country suitable for a work camp. One spring, nine bodies were found in the melting snows surrounding the town. When McCarthyville finally went "belly up," there were 100 men buried in the cemetery and only one person born during the town's brief existence.

W.H. Morrison, a McCarthyville-area trapper and prospector, acquired $3,600 one night in a poker game. Keeping the reputation of McCarthyville in mind and his money close at hand, Morrison sat a game out, but left a token $600 on the table. When no one was looking, he slipped out the back door and headed for the high country with the remaining $3,000 and a long life to look forward to.

It was from this incident that "Slippery Bill" Morrison earned his name and reputation as a gambler and a man who could live by his wits. He also passed his name on to Slippery Bill Mountain and Morrison Creek. Morrison lived to be 84 and had "squatter's rights" on land that is now the site of the Roosevelt Memorial Obelisk at Marias Pass. He is also responsible for many of the landmark names in the area.

It has been said that the only way to eternal life is through a name. Brigham Young, the man who built the Mormon empire in the West, adopted a son with his favorite wife Amelia. The boy's name was Fred Holbrook, and he was later a forest ranger in the Bob Marshall Wilderness. Fred Holbrook may no longer be alive, but Holbrook Creek continues to flow into the South Fork of the Flathead River from the Swan Range divide, south of Big Salmon Lake.

Dirty Face Creek, which drains into the Middle Fork of the Flathead, was named for "Dirty Face" McDonald, a prospector and trapper who worked in this area. In the upper reaches of the Middle Fork, Grimsley Creek and Grimsley Park are named for "Chick" Grimsley, another early-day trapper and guide who came into Montana as a boy with a trail herd from Texas. Both of these men are dead and long forgotten, but their names live on.

Names may also result from tragedies. In the winter of 1925, three forest rangers hauled the frozen body of a hermit trapper by toboggan 35 miles to Ovando. Trapper Marshall was found dead in his cabin on Cabin Creek from a self-inflicted bullet wound. His trap line was at the headwaters of the South Fork of the Flathead River. Marshall Mountain and Marshall Creek at the head of Young's Creek were both within Marshall's trapping circuit.

Montana at the turn of the century was a dangerous and sometimes cruel land to live in. Schafer Creek and Schafer Meadows on the Middle Fork of the Flathead River were both named for William Schafer, a trapper who was robbed and found murdered in his cabin on the meadow in 1908.

Both the Blackfeet and the Flathead Indians hunted and fished in what are now the Great Bear and Bob Marshall Wilderness areas. Many of the landmarks and drainages in this country have an Indian origin. In 1840, a band of Blackfeet braves were in pursuit of a hunting party of Flathead Indians who had killed bison on land claimed by the Blackfeet. The Flathead tribe had worked its way up the Sun River Valley from the grasslands in north central Montana, down Basin Creek, and had bivouacked for the night at the base of Camp Creek on the South Fork of the Flathead River. This site was a favorite camping spot for the Flatheads, and before 1930 when an airstrip was built at the site, tipi rings and other artifacts could be found there.

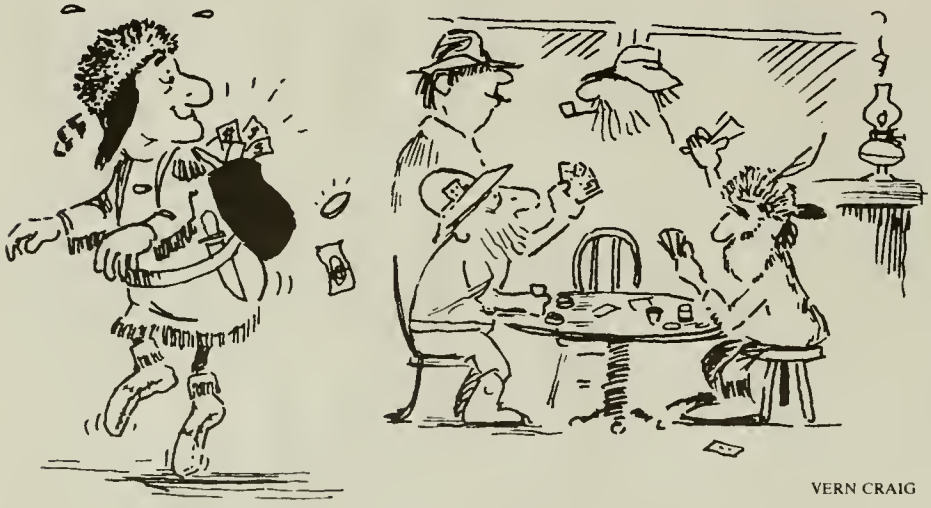
When Flathead scouts, who were watching the trail behind, noticed the Blackfeet war party approaching from the

VERN CRAIG

east, word was sent back to the Indian camp. The Flatheads wasted no time in moving the women and children out. The warriors worked their way back up the trail and waited in ambush. Taken by surprise, the Blackfeet were almost annihilated. The Flatheads continued on their journey with a winter's supply of meat.

The act of naming is spontaneous and often originates from the closest thing at hand. There are countless examples, but one of the most common is the impulse that springs from loneliness. Many of the drainages and peaks with female names, such as Helen Mountain, Grace Mountain, Lena Creek, Marion Lake, and Almeda Lake, are named for women in nearby towns and wives left at home.

The first official U.S. Forest Service trail was constructed in 1903 from Ovando to the Danaher Basin. Thomas Danaher and A.B. McCrea both homesteaded in the upper basin of the South Fork of the Flathead River and used the trail to bring in supplies and to take cattle to market. Many of the side drainages in this country, such as Calf Creek, Little Calf Creek, and others were named by these early-day ranchers.



VERN CRAIG

Admirers of a great man often pay him tribute by giving his name to some mountain top or river. Mount Cameahwait, which lies at the head of Essex Creek, is named for a Nez Perce chief, Sacajawea's father.

The Great Bear Wilderness acquired its name from Great Bear Mountain. This mountain was named by Senator Penrose of Pennsylvania when he visited northwestern Montana in the late 1880s. Penrose Peak, in turn, was named for the senator, who was in office from 1887 to 1897. Stewart Edward White was an author in the early 1900s whose short stories and books entertained his audience with their fresh outdoor quality and accounts of high adventure. Some of his books are "The Blazed Trail," "The Long Rifle," and "The Grey Dawn." The White River in the Bob Marshall was named for the writer.

In 1861 Felix Baptiste was highly recommended by the Hudson Bay Company to two California prospectors as a man who could guide them through the mountains, away from Indian trouble and onto the eastern prairies. Baptiste was a trapper who knew the wilderness, had traveled most of the trails, and had dealt with many of the Indians between Flathead Lake and the East Front of the Rocky Mountains. Taking into consideration recent disputes with the Blackfeet tribe, Felix Baptiste decided to lead the gold seekers through the mountains by way of the South Fork of the Flathead River. One crisp evening while camping at the mouth of a large side drainage, the three men noticed a strange black bear with a piebald chest feeding on the slopes above. From then on, the drainage was known as the Spotted Bear River. Mount Baptiste, Baptiste Creek, and Felix Creek are in the Great Bear Wilderness east of Hungry Horse Reservoir.

In 1909, Baptiste's dog appeared in Martin City with its ribs poking through its scraggly coat. Sheriff O'Connell and a local rancher traveled upstream to Baptiste's place and found his body in his bed; he had been dead for some time. Felix Baptiste is buried near his cabin on Hoke Creek above what is now the east shore of Hungry Horse Reservoir.

In 1964, Charlie Shaw, a ranger who worked for the U.S. Forest Service for 31 years, gathered material and wrote a history of the Flathead Valley. His book, "The Flathead Story," was a major source for this article. Shaw Mountain and Shaw Creek are just over the pass from Holland Lake on the Swan Range divide. They are, however, named for a different forest ranger, Ezra Shaw, who worked out of Seeley Lake in the early 1900s.

Although names may stick, their origins often remain secret and a mystery to those who stumble upon them. Giving a name is, however, a way of possessing something. Hidden in the mountains and prairies there are still passes, peaks, and springs waiting to be named.

Montanans Recognized

Several awards programs are conducted annually in support of efforts to promote soil and water conservation. One such program is the National Endowment for Soil and Water Conservation Awards. The State Conservation Award winners for Montana this year were Jim and Janet Schilling, Great Falls. In addition, Jim Schilling received the Outstanding Public Service Citation, awarded by the Great Plains Conservation Tillage Task Force. Jim and Janet Schilling have been practicing conservation tillage and promoting soil and water resource conservation for more than 30 years on their farm north of Great Falls.

The awards program is designed to identify and honor farmers and ranchers who are implementing sound, cost-effective conservation techniques, according to Endowment Chairman Emmett Barker. By bringing the efforts of these individuals to the forefront, other farmers and ranchers will learn how to better use and protect our soil and water.

The Schillings are not the only ones receiving recognition in Montana. The 1984 National Association of Conservation Districts-Allis Chalmers Conservation Education Awards program honored Lee Holmer and the Florence-Carlton school system for their outstanding efforts in promoting soil and water conservation education at the public school level. Holmer teaches in Florence, Mont.

Conservation Districts Aid Soil, Water Conservation

The preservation of soil productivity and water quality is a national concern, but much of the burden falls on the local soil and water conservation districts.

The first move to legislate conservation practices came in 1935 when Congress passed a law declaring that soil and water conservation and wise land use were a national policy. Two years later, President Roosevelt sent a letter to the governor of each state recommending legislation to encourage the formation of conservation districts. In 1939, the Montana Legislature passed the Montana Soil Conservation District Law, which led early in 1940 to the establishment of the first two districts, one at Reserve, near Plen-

tywood, and the other at Wibaux.

These first districts were concerned initially with countering the effects of the drought that had plagued the area for years. The construction of small earth dams to store water for livestock and irrigation was a major activity. Erosion control was another priority, and the districts helped farmers initiate practices such as planting shelterbelts and hedgerows, contour plowing, and revegetating bare areas to counter loss of soil from wind and water action.

The districts were so successful in their activities that the idea of organizing them spread rapidly. Today, there are 59 districts in Montana, covering nearly the entire state except for some lands in Prairie and Custer counties. The function of the districts broadened over the years, and now includes water quality programs, environmental education, flood control, range management, water reservations, subdivision review, stream bank protection, forest management, saline seep problems, and weed eradication. The Petroleum District, in Petroleum County, drafted and promoted an ordinance to stop "sodbusting" in the county. This ordinance was approved by the voters and became the only such law in the United States.

Cities and urban areas in the districts also receive many benefits, including flood control, improved water quality, and stream bank stabilization.

The districts are organized as a part of local government, working much like a school district or county commission, with locally elected officials. State and federal agencies provide services to private landowners through the districts. The federal agency working most closely with the districts is the Soil Conservation Service, which provides a variety of services such as soil surveys, irrigation designs, conservation tillage assistance, water and range management, salinity control, and flood prevention.

At the state level, the Conservation Districts Division of the Montana Department of Natural Resources and Conservation provides financial and legal assistance and keeps the public informed of programs offered through the districts.

Funding for the districts comes from a 1.5 mill assessment on real property with the district, and coal tax loan and grant funds.—*Ray Beck, administrator, Conservation Districts Division, Department of Natural Resources and Conservation*

Soil Conservation Marks 50th Anniversary

April 1985 marks the 50th anniversary of soil and water conservation across the nation. The anniversary reflects the beginning of the Soil Conservation Service/conservation district partnership—a partnership with the goal of helping farmers and ranchers plan and apply soil and water conservation practices.

But soil and water conservation is a broader team effort than just SCS/conservation district/farmer and rancher activity. Today the soil and water conservation movement also includes other federal agencies and state agencies, as well as agricultural and wildlife organizations.

The changes on Montana's landscape—many that are taken for granted—mark the effectiveness of this partnership for conservation. The changes include miles of alternate strips of crop and fallow, fences and water pipelines that criss-cross Montana's rangeland, and sprinklers that efficiently put water on crops.

These practices and others reflect the improving condition of the state's soil and water resources; they are helping to reduce the wind and water erosion on

cropland, improve the condition of the grasslands, and apply water according to the needs of the crop.

These changes came slowly. Montana's earliest organized federal soil and water conservation efforts were directed toward demonstration projects—"show and tell" areas for farmers to visit and learn from.

In 1939, the SCS emphasis changed from demonstration areas to working through conservation districts to help farmers and ranchers solve specific problems. Truman Anderson led the SCS in Montana for its first 22 years. He worked tirelessly to get a state conservation district law passed and then followed up with an educational program to get local districts organized. His dedication to soil conservation was so strong that after retiring from the SCS in 1957, he became executive secretary for the newly created Montana Soil Conservation Commission.

The next 25 years saw state conservationists expand on the initiatives Anderson started. Herschell Hurd, who directed the agency from 1957 through 1965, and Ave Linford, state conservationist from 1966 through 1974, focused much of their attention on the state's water resources. Under their leadership more than 50 applications for small dams for flood control and irrigation were processed. The SCS helped local sponsors plan developments on 12 of these applications, and nine of the planned structures have thus far been built.

Van Haderlie, state conservationist from 1975 through 1983, worked to help local conservation districts assume more responsibility and leadership in soil and water conservation. This was the period when the state legislature gave districts leadership in controlling work in streams and on their banks.

As the SCS enters its 50th year, it's also time to assess future directions. The challenge in the next 20 years in Montana includes slowing the soil erosion rate on cropland, which is currently the fifth highest in the nation. But it also includes reacting to grassland being converted to marginal cropland and maintaining the quantity and quality of water.

The challenges of today may not be the same as those of tomorrow. The soil conservation job will change as farming technology and economics change. But the present and future problems can be met with an effective partnership of private land users; local, state, and federal agencies; and organizations committed to maintaining and improving Montana's soil and water resources.

Every Montanan has a stake in maintaining the productivity of the soil and the quality of the water. Judging by the history of ancient cultures, it would not overstate the issue to say: Montana's future is tied to how we treat our soil and water resources.—*Glen H. Loomis, state conservationist, U.S. Soil Conservation Service*

Film Festival Set For April

The University of Montana Chapter of The Wildlife Society will sponsor the 8th International Wildlife Film Festival (IWFF) April 1-7 on the Missoula campus. Deadline for submitting applications and films is March 8, 1985.

Amateur and professional wildlife films produced or released during calendar year 1984 (exceptions must be in writing) are eligible and competition will be conducted in several categories. Entries will be judged before the festival; winning entries will receive awards, and results will be internationally published.

In addition to its regular activities, the 8th IWFF is expanding the format to include more daytime activities. Since 1985 is designated as the "Year of the

Oceans," underwater films and topics will be emphasized. During festival week, the Northwest Section of The Wildlife Society and the Third Western Black Bear Workshop will be conducted. Other programs include the Montana Alpine, Humanities and Wildlife, and a Montana Nongame Symposium.

Information, eligibility rules, application forms, and the festival agenda are available from: International Wildlife Film Festival, Wildlife Biology Program, University of Montana; Missoula, MT 59812 (406/243-4493).

MO Staffer Heads Information Group

Kay Morton Ellerhoff, associate editor of *Montana Outdoors,* has been elected president of the Association for Conservation Information, Inc. (ACI). She was elected at the group's 43rd annual conference, conducted in Chicago.

The professional organization comprises communicators within natural resource agencies throughout the United States and Canada. Members are the editors and writers of state magazines, news releases, and newsletters that go out to more than 2.5 million outdoor enthusiasts. Members also include the television, radio, and movie producers whose messages reach an equal number of outdoor recreationists.

Ellerhoff is the first president of the group from Montana, and the third woman. She previously was vice president, secretary, a member of the board of directors, and chaired the Awards Committee for three years.

She was a 1967 honors graduate in Journalism from the University of Montana and served as a graduate assistant in the School of Journalism in 1967-68. She later worked as an administrative assistant in the radio-TV department, and as a technical writer for the Division of Educational Research. She has been with *Montana Outdoors* for 12 years.

Department Film Wins Prestigious Awards

The newest Department of Fish, Wildlife and Parks documentary, "The Bridge," recently was awarded a gold medal at the International Film and TV Festival of New York. In addition, the film won a Council of International Nontheatrical Events (CINE) Golden Eagle.

The film was produced by Mike Gurnett, the department's film production supervisor.

"The Bridge" explores the types of lands the department manages. These areas are depicted as a "bridge" providing access to Montana history and to the land on which that history unfolded.

In 30 minutes, the viewer has the opportunity to imagine what life might have been like at the site of the Madison Buffalo Jump, the Missouri Headwaters State Park, and the once booming town of Bannack. The viewer's knowledge of waterfowl areas, fishing access sites, and wildlife management areas is expanded, with the importance of preserving these lands for public use underscored.

"The Bridge" is available free, for conventions, meetings, or classes. To reserve it, contact the department's Film Center at 930 Custer Ave. W.; Helena, MT 59620 (406/444-2426).

Department Employees Have "Cents-ible" Ideas

Since it was approved by the 1981 Montana Legislature, the State Employee Incentive Awards Program has saved the state over $460,000. Under the program, state employees are paid $500 or 10% of the amount of money saved by ideas they submit that the state puts to use. Dennis Taylor, administrator of the Department of Administration's Personnel Division, notes that the nearly half-million dollars already saved are first-year savings only; most of the programs will continue to save the state money every year they are in effect. Two Department of Fish, Wildlife and Parks employees are among the 24 winners to date.

John Cada, fish and wildlife biologist supervisor at the Wildlife Division's Research Laboratory in Bozeman, suggested an in-state telephone survey to replace questionnaires mailed to resident hunters by the department. The idea saved an estimated $36,000, and it earned $500 for Cada.

Gary Shaver, a hatchery worker at Big Springs Hatchery in Lewistown, developed a computer program to meet fish hatchery production needs. Shaver's program will calculate such information as the conversion of fish food to trout flesh, feeding levels, food inventory requirements, growth projections, and fish planting schedules. Since developing computer programs is not a usual job for fish hatchery employees, Shaver was awarded $500 for his efforts. His program is estimated to save $18,850 per year.

Black or Grizzly Bear?

With the spring black bear season opening April 15 (check with the Montana Department of Fish, Wildlife and Parks, 1420 E. Sixth Ave.; Helena, MT 59620, for details), it is imperative that hunters positively identify their target before shooting. Between 1975 and 1984, the department documented nine grizzly bears killed because they were mistaken for black bears. These mistakes seriously threaten the limited grizzly bear season in Montana, as well as the spring black bear season.

It is not always easy to distinguish between black and grizzly bears. Color and size are not dependable criteria, so other features must be looked for, such as overall profile, shape of the head, line of the back, and claw length. As a hunter, it is your responsibility to make a positive identification. If you are not sure, don't shoot!

Look for a combination of characteristics to make identification

BLACK BEAR

1. No prominent shoulder hump. Highest point of body is the back.
2. In profile, muzzle is straight and long. Frontally, head and face appear round.
3. Claws dark, much shorter and more curved than grizzly claws.

GRIZZLY BEAR

1. Highest point of back is a muscular hump over the shoulders.
2. In profile, distinct brow gives "dished" look to face. The brow is not as well defined in yearlings.
3. Front claws are long, very prominent, and often light colored. Can sometimes be observed from great distances.

Arresting Weeds: Ninepipe

Given time, plant succession will replace the whitetop gone to seed in the foreground of this photo. This natural process can be speeded up by mechanical control (mowing) or chemical control before the seeds mature.

"Accuse not Nature, she hath done her part, do thou but thine, and be not diffident of wisdom, she deserts thee not, if thou dismiss not her...."

—John Milton, *Paradise Lost,* 1667

Many plants provide food and cover for the more than 400 species of wildlife in Montana. Some of these same plants are undesirable from an agricultural viewpoint because they compete for nutrients, water, and space.

The Department of Fish, Wildlife and Parks owns or leases almost 400 sites in more than 30 counties—wildlife management areas, fishing access sites, fish hatcheries, state parks and recreation areas, and administrative sites. Although the department has pursued a "good neighbor" policy in regard to weeds, in 1983 it went a step further and drafted a Weed Control Program. The program's objective is: "to prevent, to the extent feasible, the reproduction and distribution of agriculturally undesirable plant species on/from department lands to adjacent private lands."

Five ways of attaining the goal of weed control are listed: (1) mechanical, (2) chemical, (3) biological, (4) grazing, and (5) reclamation.

Mechanical Control

Mechanical control is based on using mowing or cultivation to keep the green portion of the undesired plant from receiving sunlight or going to seed. This has perhaps been the main method of weed control for most of man's agricultural history, and it can be done by hand or with sophisticated equipment.

If the weeds are intensively cultivated over one growing season, they will be about 90% controlled. It is best to begin cultivation for weed control about four to six weeks after

story and photos by Mike Aderhold

the weeds come up in the spring because food reserves are usually the lowest just before budding. Early cultivation keeps the plant from going to seed and weakens the surviving portion. Cultivation must be repeated every three to four weeks until frost.

Mowing is not as effective as cultivation, but if it is properly timed, it will keep a weed from going to seed. It weakens the plant and makes it more vulnerable to competition.

Chemical Control

Chemical control goes back to the days of the Roman Empire when ashes, salt, and various inorganic wastes were used to control weeds on roadbeds. In more modern times, copper sulfate was one of the first selective chemicals used. It was used before the turn of the century to control broad-leaved weeds, particularly mustards, in cereal crops. Stove oil was once widely used to control weeds in carrots because carrots could tolerate the oil, while the weeds couldn't. Millions of pounds of inorganic salts, like sodium chlorate, are used to sterilize soils and control deep-rooted weeds in industrial areas.

However, most of the herbicides developed since 1945 are synthetic organic compounds. By 1950, about 15 basic herbicides existed. Today, there are more than 180, and about 6,000 formulated products. In 1983, farmers spent $4 billion on herbicides, with two-thirds of that amount spent for weed control in corn and soybeans.

There is no simple way to explain how these organic herbicides work. Three of the most frequently used herbicides in Montana—2,4-D, Banvel, and Tordon—influence the plant's mechanism for building the proteins critical to its growth. They act like growth hormones, stimulating the growth of some cells and tissues, and inhibiting others. The result is abnormal, distorted growth and destruction of leaves and transportation tissues.

Timing in the use of herbicides is just as important as the rate of application, and can save millions when it comes to cost versus benefits. For example, Roundup applied to leafy spurge in the fall may result in 85% to 95% eradication, while the same application in mid-June will result only in 35% to 50% eradication.

Classified as a noxious weed, wild oats adversely affects grain crops across the state.

When it comes to noxious weed control, herbicides have two weaknesses. First, perennial plants usually have large, deep root systems that can extend 150 inches into the soil; often, the above-ground plant simply cannot absorb enough herbicide to kill an entire root system. Also, parts of the root system may break off from the parent plant because of frost, insect, or disease damage. These root segments often have enough food reserves to result in a growing plant later in the season or even in the following year.

Second, seeds are even more immune to herbicides than root segments. Encased in a hard protective coat and supplied with internal sustenance from the parent plant, the seed is free from the requirements for light, water, and minerals. It's easy to see how it can survive herbicide treatment and begin its life above ground later in the season or in the following year.

Biological Control

When the undesired species is an exotic plant, biological solutions offer the best hope for practical and long-term control. The object is to short-cut the natural development of effective parasites by introducing controls already working on these plants in their native environments. The trick is to safeguard native

Disturbed soils along roads are a ready medium for invading weeds. Land management agencies are investigating the benefits of seeding such sites with plants that compete with weeds.

vegetation and domestic crops from exotic life forms whose habits may not be limited to the problem weed. The only way to be somewhat sure that the biological solution will not become a worse headache than the original problem is to go through a long and expensive testing program.

Throughout the world, biological agents, primarily insects and plant pathogens, are being evaluated for 75 to 100 weed species. Substantial or complete control using biological agents has been achieved for about 30 weed species.

In Montana, attempts to biologically control weeds go back to 1948 and the introduction of two defoliating beetles to work on St. John's-wort (goatweed). To date, over a dozen insects have been introduced to combat at least seven weed species. Two flies—one brought into Montana in 1973 and another which migrated from Canada in 1977—have cut seed production in some spotted knapweed stands by more than 50%. These flies are still expanding their range.

Control by Grazing

Just west of Missoula, University of Montana Prof. James Cox has greatly reduced knapweed on his 80 acres with 60 sheep. Early in the spring, his ewes prefer the rosettes of knapweed to grass. Later in August, the sheep select knapweed blooms. Such intensive grazing is probably not practical in large pastures or on open ranges. But the method seems to work well on a small, intensively grazed area.

Control by Reclamation

Introducing or encouraging a competitive plant is a proven method of weed control. Weeds have developed a survival strategy which includes tremendous dispersal powers and aggressive growth habits. Some weed species devote more than 25% of their energy toward reproduction. In maximizing their genetic energies toward high dispersal, reproduction, and maintaining themselves in rigorous settings, they simply have little energy left to cope with competitors. Weeds are adapted for pioneering, not persisting, and they usually decline where more persistent species are established.

All native weeds and most exotic weeds are vulnerable to the natural forces of plant succession. Arable ground may contain 100,000 weed seeds per square yard, only a fraction of which might germinate in a given year. When disturbed land is abandoned, a natural process of vegetational succession begins. First, such land is overrun by weedy annuals and short-lived perennials which help prevent soil erosion, conserve moisture, and provide the shade that the more desirable and shade-tolerant plants need to become established. Gradually, competitively aggressive grasses with extensive root systems and prolific vegetation eliminate most of the broad-leaved plants. Slowly, the seeds of shrubs, trees, and the most persistent grasses and wildflowers take advantage of improved moisture and richer surface situations and colonize the area. Once these plants

Expert Advice

Helpful weed control information and counsel is close at hand. Almost every one of Montana's 56 counties is served by a cooperative extension agent, a Soil Conservation Service (SCS) professional, and a weed control specialist.

The local extension agent is part of the nationwide Agricultural Extension Service, created in 1914 to communicate the latest agricultural research findings to the public. It is a cooperative project of the U.S. Department of Agriculture, the state land-grant institutions, and the state's farmers and ranchers. The cost is borne cooperatively by the federal government and the states and counties.

In Montana, the extension service has 50 offices, most of them in the county seat, and often in the county courthouse. The program's headquarters are at Montana State University, Bozeman. Each extension office has a helpful library, a collection of pamphlets (including almost 20 on weed control), access to weed and herbicide specialists in Bozeman, and a staff willing to research and give unbiased recommendations for specific weed control problems.

The SCS, a bureau of the U.S. Department of Agriculture, was established in 1935 to promote the protection and improvement of the nation's soil resources. In Montana, 59 soil conservation districts are served by 51 SCS offices headed, in most cases, by a county conservationist.

SCS professionals and the soil conservation districts can provide technical assistance to farmers and ranchers interested in developing long-term weed control management programs for their operations.

Every county in Montana has a Weed Control Board, and many of these have hired weed control specialists who oversee the county's actions under weed control law. Weed specialists who have been at their jobs for a while probably know more about the local weed situation, area problems, and local successes and failures than anyone else in the county. They are often in a position to give advice on what will and will not work.

Libraries subscribe to a number of magazines that popularize the latest weed control findings. The three in which weed control articles seem to appear most frequently are: *Montana Farmer-Stockman,* 208 N. 29th St.; Billings, MT 59101 (general state developments); *Organic Gardening,* 33 E. Minor St.; Emmaus, PA 18049 (non-chemical control); and *Successful Farming,* P.O. Box 4536; Des Moines, IA 50336 (chemical control).

More than a dozen Montana committees and organizations lobby for stronger weed control programs. These include the Montana Weed Control Association; Agricultural Preservation Association; Montana Agricultural Business Association; Montana Association of State Grazing Districts; Montana Grain Growers Association; Marias River Basin Weed Control, Inc.; Montana Stock Growers Association; Montana Woolgrowers Association; Montana Knapweed Action Committee; Montana Farmers Union; Montana Farm Bureau; and the Montana Departments of Agriculture, Livestock, and Natural Resources and Conservation. Addresses and phone numbers for these groups are available from the county extension officer.

begin to dominate, the abandoned land is well on its way to becoming the native prairie or dense forest that it was before disturbance.

Preventive Techniques

Control of undesirable species requires interference with one or more parts of their life system. Dependence on the five control methods above could be lessened by one little word: prevention. Prevention is the cheapest and best method of controlling perennial weeds. Over 90% of Montana still is weed-free, and can be kept that way.

Preventive techniques include: minimizing the damage caused by overgrazing and scarring by heavy equipment; buying seed or hay certified as being "weed free"; documenting noxious weeds so that small invasions can be controlled and large invasions can be prevented; cleaning equipment like combines, dozers, skidders, and hunting vehicles when moving from an infested area to a weed-free site.

Many factors determine which treatment should be used, including the dominant weed species present, moisture available, temperature, location, acreage involved, crops, and cropping system. Expert assistance is available for the asking (see the sidebar, "Expert Advice"). Those who would control weeds need to be patient and persistent. One-time efforts seldom work, and a skipped year or two can cancel five years of effort. As the following "case history" emphasizes, weeds can have severe, profound, and prolonged implications for wildlife habitat. They affect the ability of a given area to carry wildlife by displacing food and cover plants. As the Ninepipe story also illustrates, the department's efforts have gone far beyond a "good neighbor" policy when it comes to weed control on its holdings.

A Case History: Ninepipe

Twenty miles south of Flathead Lake, 45 miles north of Missoula in the heart of Lake County and the Flathead Indian Reservation, lies the Ninepipe Wildlife Management Area (WMA). It surrounds Ninepipe National Wildlife Refuge, and the two units contain the best waterfowl resting, feeding, and breeding habitat in Montana west of the Continental Divide.

During the 1983 Montana Legislature, this place was the subject of a serious discussion about noxious weeds. By the time the legislators went home, the issue of wildlife management and noxious weed control had been brought to the forefront and it became the No. 1 wildlife issue in northwestern Montana. There are still plenty of weeds at Ninepipe, but it is now regarded as one of the best examples of noxious weed control in the state.

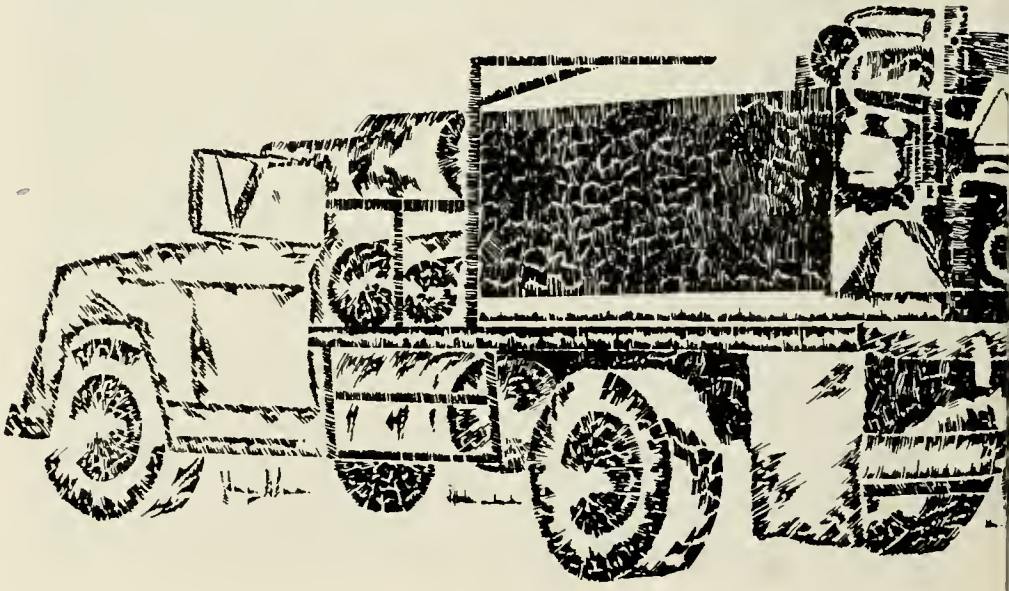
Ninepipe Reservoir was built on tribal lands in 1912 by the Indian Irrigation Service, as part of the Flathead Irrigation Project. The reservoir site was established as a National Wildlife Refuge by President Warren G. Harding on June 25, 1921. By easement agreement with the Confederated Salish and Kootenai tribes, it is now under the wildlife jurisdiction of the federal Fish and Wildlife Service and is managed by the staff of the nearby National Bison Range. The refuge contains 1,770 surface acres of water and deep marsh, and 283 acres of upland. It is closed to hunting year round.

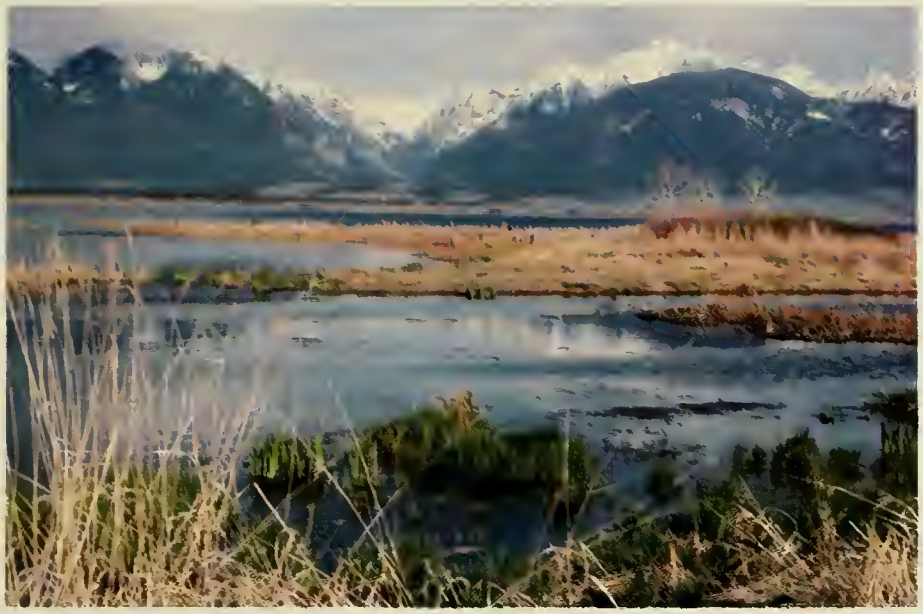
In the late 1940s, the Montana Department of Fish and Game surveyed important waterfowl sites in Montana and began purchasing some of the best of these areas to maintain waterfowl breeding and feeding habitat, and to provide for future public recreation. These purchases included the Milk River WMA (1949) in Phillips County, Fox Lake WMA (1952) in Richland County, Freezout Lake WMA (1953) in Teton County, and Ninepipe (1953) and Pablo (1955) WMAs in Lake County.

Between 1953 and 1974, the state purchased 26 parcels of land surrounding the federal Ninepipe Refuge. The total state holding at Ninepipe is now 2,983.92 acres which, combined with the refuge, blocks up an area of slightly more than 5,000 acres.

The land acquired at Ninepipe was marginal for agriculture, although much of it was being cultivated or had a history of cultivation. Generally, the soils are rocky, heavy, and slow to accept water. In addition to the reservoir, there are at times over 800 seeps, potholes, and small impoundments on the site. The unit also has nine small dams, 18 miles of ditches, over 30 miles of boundary fence, and 18 shelterbelts covering 75 acres with 53,000 hand-planted trees and shrubs.

The Department of Fish, Wildlife and Parks employs a full-time manager at Ninepipe, and a summer assistant. Small grains, mostly winter wheat and barley, have been grown on the site every year since the state purchased the land. The grains provide food for resident and migrating wildlife and minimize off-site crop depredation. Traditionally, most of the farming is done by sharecropping; the farmer receives two-thirds to three-fourths of the crop and the rest—the "rent," or state share—is left standing for the birds.





The Ninepipe Wildlife Management Area, which surrounds Ninepipe National Wildlife Refuge, is now regarded as one of the best examples of noxious weed control in the state.

The first sharecrop agreement was signed in 1954 with a farmer whose land had been purchased. As land purchases continued, the number of sharecroppers and acreage farmed increased until, in the mid-1960s, 12 sharecroppers were farming 1,250 acres. Following this high, the sharecroppers began to drop out and cultivated land was converted to grass and clover. Most of the sharecroppers simply retired. None were forced to leave. In 1980, the last sharecropper left Ninepipe. At that time, the department was farming about 550 acres, with the rest converted to dense nesting cover, grass, or clover.

In 1981, the department tried to manage the area alone. The attempt failed—there was just too much for two people to do. The spring in which Mount St. Helens erupted (1980), rainfall was above normal throughout the growing season, and it resulted in abnormal plant growth, especially in plots of dense nesting cover. In 1981, many of these plots, planted throughout the 1970s, failed to green up. The areas with the thickest plant cover had the poorest survival. This problem was probably due to a combination of water saturation, a shaded soil surface, rodent damage, and maybe some plant diseases brought on by the rich microclimates. Problems of this nature occur to some degree every year, but 1981 was a disaster.

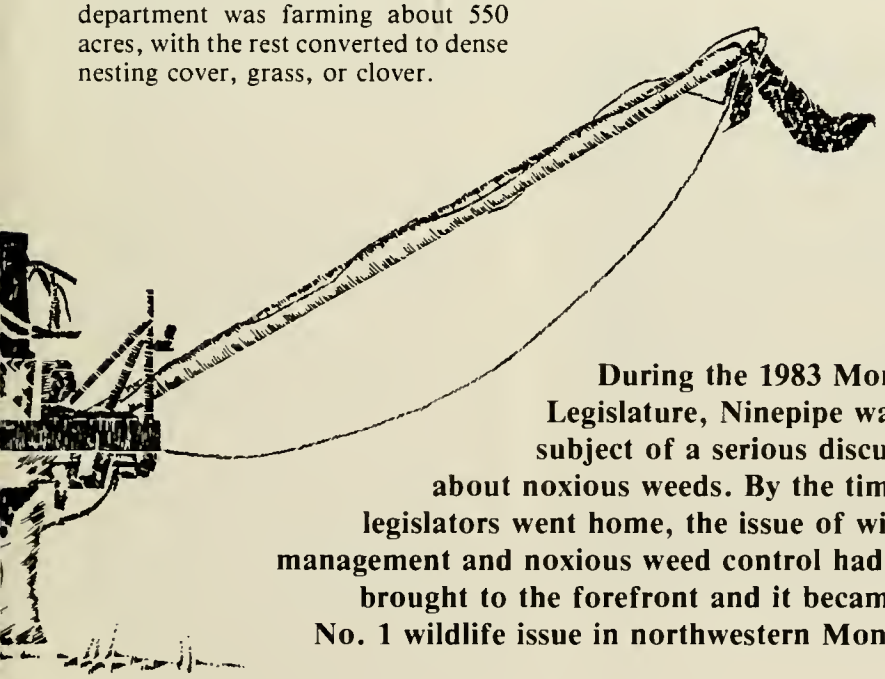
The matted plants became ideal havens for rodents, and the dirt mounds that the rodents built became ideal sites for weeds. While Ninepipe was never free of weeds—even before the land was purchased—weeds were a greater problem in 1982 than at any time before.

In 1983, the legislature held Ninepipe up as an extreme example of Montana's noxious weed problem. Management of the site was criticized as ineffective, inefficient, and in violation of the state's weed control laws.

A joint House/Senate Resolution was proposed that said: "Unless the noxious weed problem is effectively controlled by Jan. 1, 1985, [Ninepipe]...[should]...be offered for public sale...." Later, over 300 Lake County residents, many of them farmers and ranchers, signed a petition complaining about the weeds at Ninepipe; the petition was presented to the committee hearing the Department of Fish, Wildlife and Parks' budget requests. It was embarrassing, but there was no escaping the fact that Ninepipe WMA had one of the worst Canada thistle and whitetop problems in the state.

It didn't matter that in Lake County, the Department of Fish, Wildlife and Parks controlled less than six-tenths of 1% of the land, and that there were noxious weeds uphill, upstream, and upwind from Ninepipe. Nor did it matter that in 1981 the area produced more pheasants than at any time since 1968, and that in 1982, Ninepipe had the best waterfowl production in 15 years. The point was: The state was part of the problem, not part of the noxious weed solution.

In spring of 1983, the crew at Ninepipe WMA rolled up its sleeves and tackled the problem. Three new sharecrop agreements were signed to farm 1,160 acres. The sharecroppers, as always, were given the freedom to farm the state's land as they farmed their own places. Sharecroppers were expected to control weeds on the



During the 1983 Montana Legislature, Ninepipe was the subject of a serious discussion about noxious weeds. By the time the legislators went home, the issue of wildlife management and noxious weed control had been brought to the forefront and it became the No. 1 wildlife issue in northwestern Montana.

lands they cultivated, and they did an excellent job.

For the first time, however, the department restricted herbicide use to 2,4-D Amine, MCPA, Banvel (dicamba), and Roundup (glyphosphate). The fact that the department allowed any herbicide at all generated a number of complaints and letters of concern. The issue of "too many noxious weeds" started to change into a spray/no spray confrontation.

Herbicides have been used every year since the state began acquiring the lands (and probably before). Except for aerial spraying, herbicide use had never been restricted. All of the sharecroppers used some herbicide nearly every year. From 1955 through 1970, the department paid the Lake County Weed Board between $1,500 and $2,000 per year to spot-spray noxious weeds. Between 1970 and 1984, the department has tried to control weeds by mowing and tilling, but the sharecroppers were permitted to continue using herbicides.

The letters sent opposing use of herbicides expressed honest concern for the long-range impacts of chemicals on soil, water, wildlife, and human health. Because of them, the department researched the issue and prepared a preliminary environmental review for its proposed management at Ninepipe. This environmental assessment was explained at a public meeting in Ronan and consent was achieved. The current program at Ninepipe involved input from a number of individuals and the Cooperative Extension Service at Montana State University, the Soil Conservation Service, the Lake County Soil Conservation District, and the Lake County Weed Control Board.

During summer 1983, Bureau of Indian Affairs (BIA) fire crews and state personnel burned 1,400 acres of dense nesting cover. This rejuvenated the grass stands and removed the matted vegetation that encouraged the rodent populations and weed infestations. The sharecroppers planted 250 acres of wheat and 330 acres of barley, and fallowed another 700 acres for fall and spring plantings. The department plowed and kept fallow about 200 acres and mowed 650 acres to control weeds by keeping them from going to seed. The Flathead Irrigation Service is removing

Yellow sweetclover and white sweetclover compete well with noxious weeds and provide forage for both livestock and wildlife.

many of the rock piles that have perennially harbored weeds and using them for fill and riprap.

Fortunately, all of this disturbance was offset by unusally good wildlife weather; in fall of 1983, the Ninepipe area held the second best pheasant crop since 1968 and continued a 20-year improvement in waterfowl production.

During spring 1984, 325 additional acres of dense nesting cover were burned by Wildlife Manager Don

Weeds just beginning to flower, such as this sow-thistle, are at a low point in their energy cycle, and thus more susceptible to control efforts.

Shepard and BIA fire crews. A total of 140 acres was sprayed with a mixture of Banvel and MCPA to control whitetop, Canada thistle, and small infestations of spotted knapweed. Sharecropping continued on 1,160 acres, half of which was fallowed to control weeds. One sharecropper sprayed Roundup on several small patches of quackgrass.

About 500 acres were mowed, 400 under contract, and the rest by department personnel. About 150 acres were seeded with a mixture of alfalfa, tall wheatgrass, yellow sweetclover, orchard-grass, and smooth brome to provide competition for weeds and nesting cover for waterfowl. The department has continued to coordinate its program with the Lake County Weed Control Board and with the local county extension agent.

In all, the 1984 weed control program at Ninepipe cost the sportsmen of Montana $3,801.91 above regular management expenses. State and contract mowing averaged $5 per acre, or $2,500. Three gallons of Banvel, 15 gallons of MCPA, and five gallons of a wetting agent were used (to make the chemicals adhere), at a cost of $166.07, $202.09, and $30, respectively. The department's spraying machine was run 415 miles ($103.75), and part-time help cost $800.

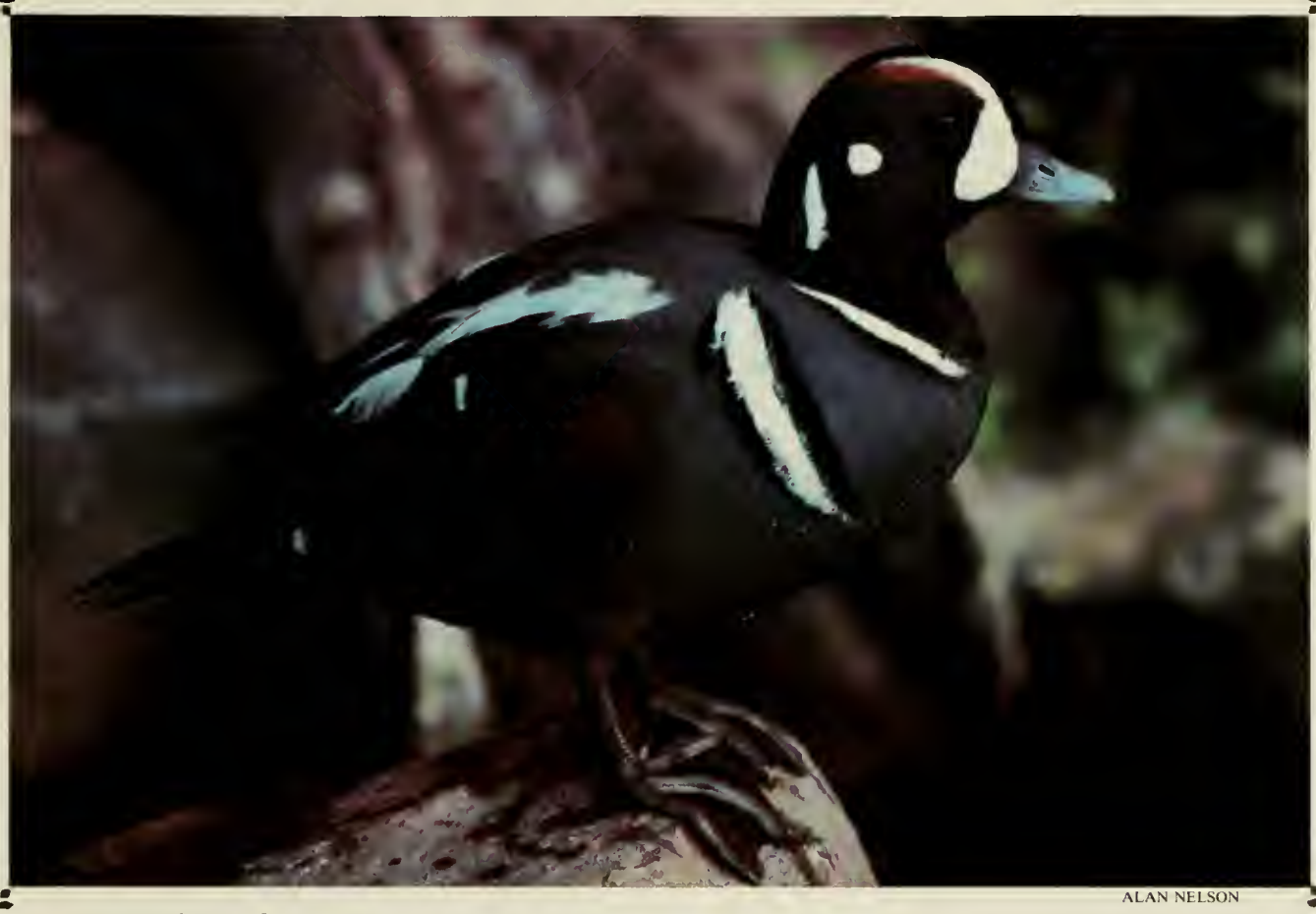
The weed problem still exists, but more and more, the area is again viewed for its assets—186 species of birds (73 species nesting) and a dozen mammals—than for its liabilities: noxious weeds.

Summary

The U.S. Department of Agriculture estimates that weeds cost farmers about 10% of the value of their crop production. This 10% loss in crop, livestock, forest, and aquatic production is valued at more than $12 billion. Add to that the approximately $8 billion farmers spend to control weeds—and you come up with a whopping *$20 billion* for weed control annually in the United States.

In many ways, the abundance of weeds and the nature of vegetational change have been shaped by human impact on the landscape. But don't blame nature. "She hath done her part." Now it is time for us as land managers to do our part. ■

A Harlequin Romance



ALAN NELSON

by Larry S. Thompson

This harlequin romance began in a driving December rainstorm off the rocky coast of Washington.

Amid the crashing breakers, a lord wooed his lady, and the two set off together on a honeymoon voyage to the Montana Rockies and Glacier National Park.

The lord (a nickname given by Colonial settlers in reference to his regal regalia) cut a striking figure as he rode the waves. Against a background of gun-metal blue, he sported flashy patches of cinnamon-chestnut on his sides, and bright, neatly outlined spots and crescents of brilliant white on his face, neck, and back. Resemblance to Harlequin, the gaudily clad character of Italian comedy and pantomime, was clearly there—he seemed all costumed up in anticipation of playing some outlandish role.

His lady was far more modest. Clad in drab grey-brown broken only by three whitish facial patches, she was scarcely visible in the swirling surf.

The courtship continued through the winter and early spring, as the two slowly worked their way up the Columbia River. They swam most of the way, drawn like salmon toward the headwaters some 600 miles distant.

As spring advanced, the lord stepped up the intensity of his overtures. Again and again he rushed toward his lady, each time throwing his head back, then snapping it forward, bill open. A certain amount of "necking" occurred during the courtship. Charles W. Michael, who "spied" on a courting pair in Yosemite Valley, described the performance: "They were bobbing and bowing to one another, swirling around, touching their bills together, and uttering little chatty sounds. One of the moves on the female's part was to slowly submerge her body until just her head and neck appeared above the surface of the water—a bold invitation on her part for attention." The lord was heard to utter a sound "reminiscent of a group of fighting mice." By the time the couple crossed the border into Montana in late April, the pair bond was firmly established.

Harlequin ducks are among the rarest and most interesting of Montana's wildife species. They have a spotty distribution pattern which includes northwestern and northeastern North America, Greenland, Iceland, and eastern Siberia. Within this

range, they are the only exclusively whitewater waterfowl species. During the breeding season, they are found only in crashing, turbulent mountain torrents, rapids, and waterfalls. South of the equator, this niche is filled by two other duck species, the torrent duck of the South American Andes and the mountain duck of New Zealand.

Harlequins were first discovered in North America off the New England coast. They were not suspected to breed inland in the Rocky Mountains until 1860, when Ferdinand Vandiveer Hayden and George H. Trook (naturalists with the Raynolds Expedition that circled the Yellowstone National Park region) collected a pair in the Wind River Range east of Jackson Hole, Wyo. The female contained an egg, indicating that nesting was probably about to occur.

Nesting in the Rockies was first documented in Montana by ornithologist Elliott Coues in 1874. Coues was serving as naturalist to the Northern Boundary Commission, which was surveying the U.S.-Canadian border from Lake of the Woods, Minn., to the Continental Divide. Coues had spent a hot, dry summer tramping across the sweltering plains and had finally reached the oasis he had awaited so long—the Rocky Mountains of what is now Glacier Park. There, in late August, Coues came across broods of young harlequin ducks. He found them east of the Continental Divide near Waterton Lake, "in a clear ice-cold mountain torrent, disporting in a pool at the foot of a cascade." When disturbed, Coues observed, the mother bird "flew low over the water, while [the] others sank back quietly into the limpid element, till only the head remained above the surface—just like grebes; some sought refuge behind and beneath the cascade, screened by the whole volume of water that leaped over the projecting rocks."

It seems that harlequins have always been scarce and rarely seen in Montana. In 1881, James C. Merrill, an Army naturalist stationed at Fort Custer (near present-day Hardin), found several pairs breeding in the Bighorn Mountains area on the Montana-Wyoming boundary—probably in the whitewater of Bighorn Canyon. Almost nothing more was seen of harlequin ducks in Montana for many decades. As late as 1921, harlequins had been reported from only three additional localities: Flathead Lake, the West Gallatin River, and Birch Creek along the Rocky Mountain Front west of Dupuyer. The wild mountain torrents of Glacier Park, however, were found to offer favorable habitat for the whitewater lords and ladies; breeding pairs were reported widespread, if not common, within the park boundaries.

Harlequins remain rare in Montana today; few additional breeding sites are known. A few pairs breed in the hidden, fir-choked gorges of the Purcell, Cabinet, and Salish mountains. A few more hide out in the Bob Marshall Wilderness and in the remote headwaters of streams which slash through the Rocky Mountain Front east of the Continental Divide. Small populations once occurred in the Rattlesnake Creek drainage north of Missoula and in the Mission Mountains, but these seem to have disappeared. They also seem to have vanished from the Bighorn Mountains, although Dr. Robert Eng, professor of biology at Montana State University, and his students have found up to eight pairs along the Boulder River in the Absaroka Mountains. Harlequins are still occasionally seen in Yellowstone Park, sporting dangerously at the brink of the lower falls of the Yellowstone River or cavorting in the whitewater below Fishing Bridge.

There are only two readily accessible sites in Montana where harlequin ducks can regularly be observed. One is along McDonald Creek above McDonald Lake in Glacier Park. Another is at the head of Kootenai Falls along U.S. Highway 2 about 10 miles west of Libby. Biologist Craig Kuchel of the University of Montana studied breeding harlequins along McDonald Creek during the summers of 1973-76, and the small population at Kootenai Falls has been observed by numerous biologists since 1978. The only other place in the world where harlequins have received detailed study is Iceland. While knowledge about them is still sketchy, results of these few studies—two in Montana, and one in Iceland—allow us to continue with the plot of our harlequin romance.

By the time the paired lords and ladies arrive in northwestern Montana in late April, flocks of "bachelor" males—those unsuccessful in wooing a lady—have already been hanging around for a couple of weeks. Perhaps they were able to move a little faster than the paired couples since they did not have to involve themselves in the nonsense of bill-open rushing and mouselike squealing.

To the harlequins, the last few days of April and the first week of May are truly halcyon days. The 600-mile odyssey is over, the summer home has been safely reached, and the birds do little but loaf around on rocks, sleeping and preening—and mating. This is one of the best times to observe harlequins, since "clubs" including both paired and unpaired birds gather on rocks out in the current where they are safe but highly visible. Several birds can often be spotted on the rocks near the south shore of the Kootenai River just above the crest of Kootenai Falls. Mating occurs during this relaxed time.

Even at such favored localities as Kootenai Falls and Glacier Park, harlequins are far from abundant in Montana. Along tributaries to the River Skjálfandafljót in Iceland, harlequin pairs number up to 14 per river mile during good years. In contrast, only one or two pairs per mile are found along McDonald Creek in Glacier, and it seems that only one breeding pair regularly visits Kootenai Falls (although up to six or eight adult birds use the falls area each year). The pairs do not seem to be territorial, but appear to space themselves according to availability of their favorite food: aquatic insects.

Harlequins rely for food on many of the same insects as do trout. The aquatic life stages of stone flies and mayflies are preferred, and harlequins also eat the larvae of blackflies. In Iceland, where there are no stone flies or mayflies, blackfly larvae are the major food source for harlequins, and population ups and downs of blackflies and harlequins occur in concert. It is fascinating to watch harlequins feed. They are perfectly able both to fly and to walk underwater, in spite of the swift, turbulent currents of their preferred habitat. They move through the water like turtles, working the spaces between the river cobbles for insects. Harle-

continued on page 24

READERS RESPOND

Comments on Cutthroat And Butterflies

I have two responses to share, one about the cover of your May/June 1984 issue, and the other on the July/August 1984 article about Morton J. Elrod's butterfly collecting.

Glacier National Park may not be as well known for its fly-fishing as Yellowstone National Park, but it does offer rewards for the stream and lake fisherman, as in Two Medicine Lake, shown on your May/June cover. It's a much photographed locale with Sinapah (Mount Rockwell) as a superb background.

Apparently, when George Wuerthner took your shot of the fisherman, the fish weren't biting. As you will see from the post card, made on commission years ago for the Great Northern Railroad by photographer Walt Dyke, the "compleat angler" was doing somewhat better. But wait. Was he? Perhaps conditions have not changed that much, as to a cooperative trout ready to give dramatic emphasis to such a picture.

I speak authoritatively, because in the Dyke photograph, *I* was that fish, jumping to the bait and ready to be scooped up in the net! It so happens that I was a casual bystander when Mr. Dyke was "trying" for an action shot. Because the fish were not compliant, he asked me to throw stones in the water in such a way as to give the appearance of the fish breaking the surface. In other words, it was my

well-cast stone that gave the postcard, Mr. Dyke, and the Great Northern such a sense of excitement and success. It was *not* a Two Medicine Lake cutthroat.

In your July/August feature, "Collecting Butterflies in Montana" (a chapter from Morton J. Elrod's 1906 publication, "The Butterflies of Montana"), Larry S. Thompson, who wrote the introduction, makes no mention of another area of (later) renown for which this splendid naturalist and writer is even better known, at least to non-lepidopterists. I refer to the 1924 "Elrod's Guide & Book of Information," Glacier National Park.

I am sending along several photographs to honor Mr. Elrod's pioneer work. Glacier had only been established a short while (1910) when Mr. Elrod must have begun his comprehensive study and explication of its trails, natural features, and many wonders. He put out the first definitive guide; only in 1949 was it superseded (although it had long been out of print) by George Ruhle's "Guide to Glacier."

It still, however, makes fascinating reading, including the often quaint writing style of the period. Perhaps someone will do a kind review of it one day for *Montana Outdoors,* although the photographs are, of course, black and white. Mr. Elrod wrote entertainingly and informatively, with sections on the fauna and flora. But he made no reference to the butterflies of the area, that now we note Mr. Elrod was such an authority in classifying and describing.—*John R. Mauff; Chicago, Ill.*

One Set of Shoulders

I have been a subscriber to *Montana Outdoors* since it was first issued, and I have enjoyed it very much. Your contributors seem very knowledgeable and do a fine job.

However, in your Sept./Oct. 1984 issue, in the article "Black or Grizzly Bear?" on page 12, you list the ways to identify a grizzly bear. Item No. 1 indicates a grizzly has a hump over the *front* shoulders. To my knowledge, all animals have only one set of shoulders. This is a common expression, and I wonder how it got started.—*J.L. Jeffries; Saltese, Mont.*

Barsness' "Perspective" Applauded

John Barsness' "Perspective" in the Nov./Dec. 1984 issue was "right on!" So many self-proclaimed outdoor writers use volumes to tell what John says in a brief page.

The "problem" is not only in Montana, but in Wyoming, and probably in the other Rocky Mountain states as well.

Hunters' attitudes have changed along with the development of equipment which is hyped to have tyros believe such gadgetry can replace skill. It takes many years of field experience to realize that wits cannot be bought in a sporting goods store.

Native or out-of-state isn't quite as important as character! Too many selfish hunters (on both sides) use the resident/nonresident terminology as an excuse when they are unable to beat game animals on their own terms—even with megabuck trucks, superior optics, and modern firearms.

Well done, John Barsness! Now if only the stubborn ones with heads buried à la ostrich would turn their pointed fingers onto themselves!—*Frank R. Baner, Photographic and Editorial Services; Alcova, Wyo.*

A Little More Beauty

For the past two summers, I've had the great pleasure to work in Montana. I don't think I've ever seen country that is so beautiful.

So I want to see a little more of that beauty by subscribing to *Montana Outdoors.*—*Marty McKaig; Athens, Ga.*

Get Your Back Issues Here!

As a recent subscriber to your outstanding publication, I share with my family the enjoyment of each issue of *Montana Outdoors.*

While my wife, a native of Montana, has thoroughly imbued me, a native of California, with the extraordinary merits of Montana and its pristine environmental qualities, I am remiss with the fact that only recently have I become acquainted with *MO.* I hope to remedy this glaring oversight. Are back issues of your publication available? What is the cost per issue?—*Ben L. Brenchley; San Jose, Calif.*

• *Yes, we have back issues. The following are available for $1.50 per issue, plus 25 cents postage:*
1971—May/June, July/August, Sept./Oct., Nov./Dec.
1972—July/August, Sept./Oct., Nov./Dec.
1973, 1974, 1975, 1976—all issues
1977—Yellowstone Special Issue, plus all regular issues
1978—all issues, except May/June
1979—all issues
1980—Special Hunting Issue, March/April, May/June, Sept./Oct., Nov./Dec.
1981, 1982, 1983, 1984—all issues
Address orders to: Back Issues, Montana Outdoors, *Department of Fish, Wildlife and Parks; Helena, MT 59620.*—Ed.

A Harlequin Romance

continued from page 22

quins are precision divers; they can come up in almost exactly the same place from which they dove, again in spite of the swift currents. Some of their feeding sites are so turbulent, it is difficult to imagine how they escape being dashed to pieces.

I once spent two hours watching a couple of male harlequins feeding in a reach of swift, but shallow, water. It was April 5, and the birds had probably just arrived. When I first spotted the ducks, they were standing on some rocks a short distance upstream, dozing and occasionally preening. I watched them for a few minutes and decided they were ready to sack out for the night. It was evening, and they showed few signs of vitality. Suddenly, as if on cue, both birds slid into the water at the same instant and began floating downstream, like bits of colorful driftwood, toward the riffles. I was amazed by the perfect synchroneity of their movements. When one duck changed direction, the other did so in perfect unison. When one looked sideways, the other did so at exactly the same instant. Together they bobbed over a rock ledge and entered shallow, swift water where they began to feed.

The harlequins used two quite different feeding techniques in this relatively shallow water. For a while, they dove underwater and worked the rocks on the streambed for aquatic insects. The water was so shallow—probably less than three feet deep—that the dives were short. Each dive lasted for 10 to 15 seconds, with a break of only three or four seconds in between. The dives were often made in unison. After a bit, the birds climbed onto a rock ledge to rest. Still acting in perfect synchroneity, the two stood and flapped their wings together as though choreographed. Then, looking like mirror images of one another, they shook their heads in absolute unison. There they stood for a while, watching two mallard drakes and a hen who were also feeding.

One of the mallard drakes, looking huge and clumsy in comparison to the small, graceful harlequins, clambered onto the rocks right between the two harlequins, and knocked one of them

off balance and into the water. The harlequin appeared miffed and charged the mallard. The mallard bumbled onward, unaware of the angry little harlequin. The harlequin then swam around, angrily bobbing its head every second or so. The mallard continued stumbling over the rocks, totally oblivious of the display being made for its benefit.

After the commotion had settled, the harlequins resumed feeding, this time adopting a different method. The birds slowly walked from their rock ledge into very shallow water—probably less than a foot deep—and began dabbling. The method of dabbling was not the end-up posture of a typical dabbler, however. The harlequin's body remained horizontal, but sank deeper into the water until only about a quarter of it was visible above the water—a small, steel-grey hump, looking very much like the back of a turtle except for the two white patches on the back. All the while, the head end was busy working the rocks on the bottom for the abundant insects that lived there. All in all, these harlequins had a pretty easy life, compared with those living in habitats where food must be obtained by long, difficult dives in deep and turbulent waters.

About the second week in May, after a 600-mile courtship and a leisurely mating among the sheltered rocks, the ladies begin exploring the river shoreline for a nest site. The female walks around on the islands and shorelines for hours, exploring and poking into every chink and cranny and under every bush. The lord tags along, but doesn't help much. He mostly stands around disinterestedly, gazing into the distance and letting the female do most of the shopping. Finally, she chooses a suitable nest site: a chink in a rock, a cavity in a tree, or on the ground under a protective bush, but always close to water. Harlequins particularly favor island nest sites. At Kootenai Falls, Carl Wolf and other birders discovered a harlequin nest in an inaccessible log jam at the head of the falls. The pair nested there for two consecutive years, but unfortunately the log jam was partly washed away during the high flows of 1983.

In Montana, the female harlequin lays her eggs around the middle of May, about the time when spring runoff begins in earnest. Incubation occurs during May and June, at the time of peak runoff, and takes about a month. According to Craig Kuchel, the timing of incubation is keyed closely to the peak of runoff—a time when high, turbid waters depress insect populations and make feeding difficult. During the peak runoff, the lords disappear. They begin to molt their post-breeding or "eclipse" plumage (which is drab and similar to that of the female) and start the 600-mile return journey to the Pacific Ocean—scarcely eight weeks after they arrived. If you hope to catch a lord in his full nuptial regalia, you had better visit the breeding grounds before the end of June.

Harlequin ducks are among the rarest and most interesting of Montana's wildlife species....

Young harlequins begin to appear around the first of July. By this time, runoff has subsided. Aquatic insect populations are recovering, providing an abundant source of food at this critical period. Females with broods are rarely seen, because they are extremely wary of human activity and keep to secluded, quiet pools between stretches of whitewater. Broods are reared in July and August; young are ready to fly at about two months of age.

Near the end of August, the harlequins leave Montana, not to return until the following April. However, a few stragglers linger in Montana into fall and winter. Females are occasionally taken near Libby by duck hunters during waterfowl hunting season, and one male was seen at Fort Peck Reservoir on March 18, 1984.

Harlequin ducks are what biologists call "k-strategists"—a term referring to the overall strategy the species has developed to ensure its survival. "K-strategists" are the long-lived species, with relatively small, stable populations. They tend to breed at a comparatively advanced age, to have very small families but low infant mortality, and to be closely adapted to a specific type of habitat. Other examples include the moose and bald eagle. In contrast, some other species are what biologists call "r-strategists." They are abundant, short-lived animals, adaptable to many kinds of habitat, and early, prolific breeders. Many young are produced, most of which die quickly. Examples are deer mice, rabbits, and many songbirds.

According to Kuchel, harlequin ducks—like many other k-strategists—are vulnerable to habitat alteration. This is because they have become so closely tied to specific habitat needs—in the case of harlequins, to whitewater. Anything that changes the stable habitat conditions to which k-strategists have become adapted over millennia can have disastrous consequences for the local population.

Perhaps some subtle change in breeding habitat—overgrazing of stream banks by cattle; introduction into streams of brook, brown, and rainbow trout (which compete for the harlequins' food source); dewatering of mountain streams for irrigation—has contributed to the demise of breeding harlequin populations over parts of their former range. Today, increasing pressure for hydroelectric development—including microhydro—on the last remaining whitewater reaches of Montana's streams and rivers probably poses the greatest single threat to the continued existence of harlequin populations in the state.

Together again off the Washington coast, the lords and ladies gather in hidden coves and inlets, far from the haunts of man. The harlequin romance has reached the end of its cycle. But another cycle is about to begin. Already there are restless stirrings deep within the birds' chemistry. Already the males have begun to molt into their harlequin breeding plumage. Soon they will begin the long—but oh so memorable!—return to the wild canyons of northwestern Montana.

Montana's whitewater lords and ladies are a unique and fascinating part of our natural heritage. With a little knowledge, foresight, and stewardship on our part, the harlequin romance will also be a part of our grandchildrens' heritage. ■

CONTRIBUTORS

• Among other attributes, the Elkhorns offer diverse hunting opportunity, including one of Montana's most popular and productive elk hunting areas. The unrelenting public interest in the fate of this mountain range south of Helena has led to the U.S. Forest Service (USFS) decision to emphasize wildlife as the primary resource management value. As **Rich DeSimone** writes, "The decision by the USFS to manage an area as large as the Elkhorns specifically for wildlife is unprecedented." "The Elkhorn Experiment" demonstrates that a productive federal/state relationship can result in creative land management responsive to public concerns. DeSimone is a biologist for the Department of Fish, Wildlife and Parks, and has assisted the USFS in development of a Wildlife Management Unit in the Elkhorns. His article begins on page 2.

• In Montana, the "Old West" becomes new when you see a vista that inspired Charlie Russell. Or when you stop along the banks of the Missouri at the exact spot described nearly 180 years ago in Lewis' and Clark's journals. One place that offers a "rich accounting of yesterdays" is the Sluice Boxes State Monument. It lies concealed on Belt Creek in the Little Belt Mountains, and you can still see some of the trestles from the early-day railroad that carried ore to smelters. Managed by the department as a natural area, a visit can be a bridge "Back from the 'Iron Horse' " into today. Turn to **Mike Gurnett**'s article on page 8. He is the supervisor for the department's film production unit.

• If you've spent much time around a body of water called "Snake Creek," you'll probably have a fair notion of how it got its name. In "Travel On, But Leave a Name Behind," **James J. Jonkel** describes the events behind the names of some landmarks in the Bob Marshall and Great Bear Wilderness areas. Names like Waldbillig Mountain (where murder is part of the story), or Slippery Bill Mountain (based on escape with winnings intact), or Dirty Face Creek (named for a prospector whose long suit was probably not soap and water). Jonkel's article headlines this issue's "The Catchall" section, beginning on page 11. Jonkel holds a B.S. in wildlife biology, and he recently completed his B.A. in journalism, both from the University of Montana, Missoula. He has spent several years working with the Interagency Grizzly Bear Study Team in Montana and Wyoming.

• The weeds at the Ninepipe Wildlife Management Area came up at the 1983 Montana Legislature. More specifically, a joint House/Senate Resolution was proposed that said the area should "be offered for public sale" unless the noxious weed problem could be effectively controlled. In Part Two of a series on weeds (page 15), **Mike Aderhold** examines some of the tactics used by the department in "Arresting Weeds: Ninepipe." Although the area is certainly not weed-free, it is now regarded as one of the best examples of noxious weed control in the state. Ninepipe is once again viewed more for its assets—186 species of birds and a dozen mammals—than for its liabilities: noxious weeds. Aderhold is the department's information officer for Region 1 (Kalispell).

• **Larry S. Thompson**'s article is "A Harlequin Romance" you won't want to put down. It's a story of courtship and of breeding against a backdrop of crashing, turbulent mountain torrents, rapids, and waterfalls. As Thompson notes, harlequins have always been scarce and rarely seen in Montana, which only adds to their attractiveness. Two sites in Montana offer a reasonably good opportunity to see them: along McDonald Creek above McDonald Lake in Glacier National Park, and at the head of Kootenai Falls not far from Libby. Thompson is the biological sciences coordinator for the Department of Natural Resources and Conservation. His book on 19th century Montana explorer-naturalists will be published this spring as part of the Montana Geographic series. Turn to page 21 for his article.

• **Shirley Cleary** aficionados will be delighted by our March/April cover, "Playing a Fish." The site is the Clark Fork River, and the setting and activity are both displayed with the usual Cleary accuracy and subtle flair. Fishing is an important aspect of both her personal and professional life: Cleary sits on the board of directors of Helena's chapter of Trout Unlimited; one of her paintings was purchased for the permanent collection at the International Headquarters of the Federation of Fly Fishermen. Her work can be seen at the Tatem House and the Artful Framer, Helena; Bud Lilly's, West Yellowstone; and Hole in the Wall, Ennis.

The Cleary cover leads the reader to "A Clark Fork Legacy" on page 27. **Larry Peterman** is quick to point out that the Clark Fork is not like most of Montana's major rivers whose headwaters lie in unspoiled mountain valleys, national parks, or large wilderness areas. The Clark Fork's headwaters "begin or flow through three hazardous waste sites." Its headwaters have endured over 100 years of intensive mining activity—and for over 70 years, the Clark Fork received the untreated effluent from one of the largest mining ventures on earth. Little wonder that much of the fish life in the upper Clark Fork was all but eliminated. But some rungs on the ladder to recovery of the Clark Fork have been built, and major efforts have been started on several fronts to identify and begin to tackle the significant problems still facing the Clark Fork. Peterman is the department's water resources supervisor, in charge of preparing the instream flow reservation for the upper Clark Fork.

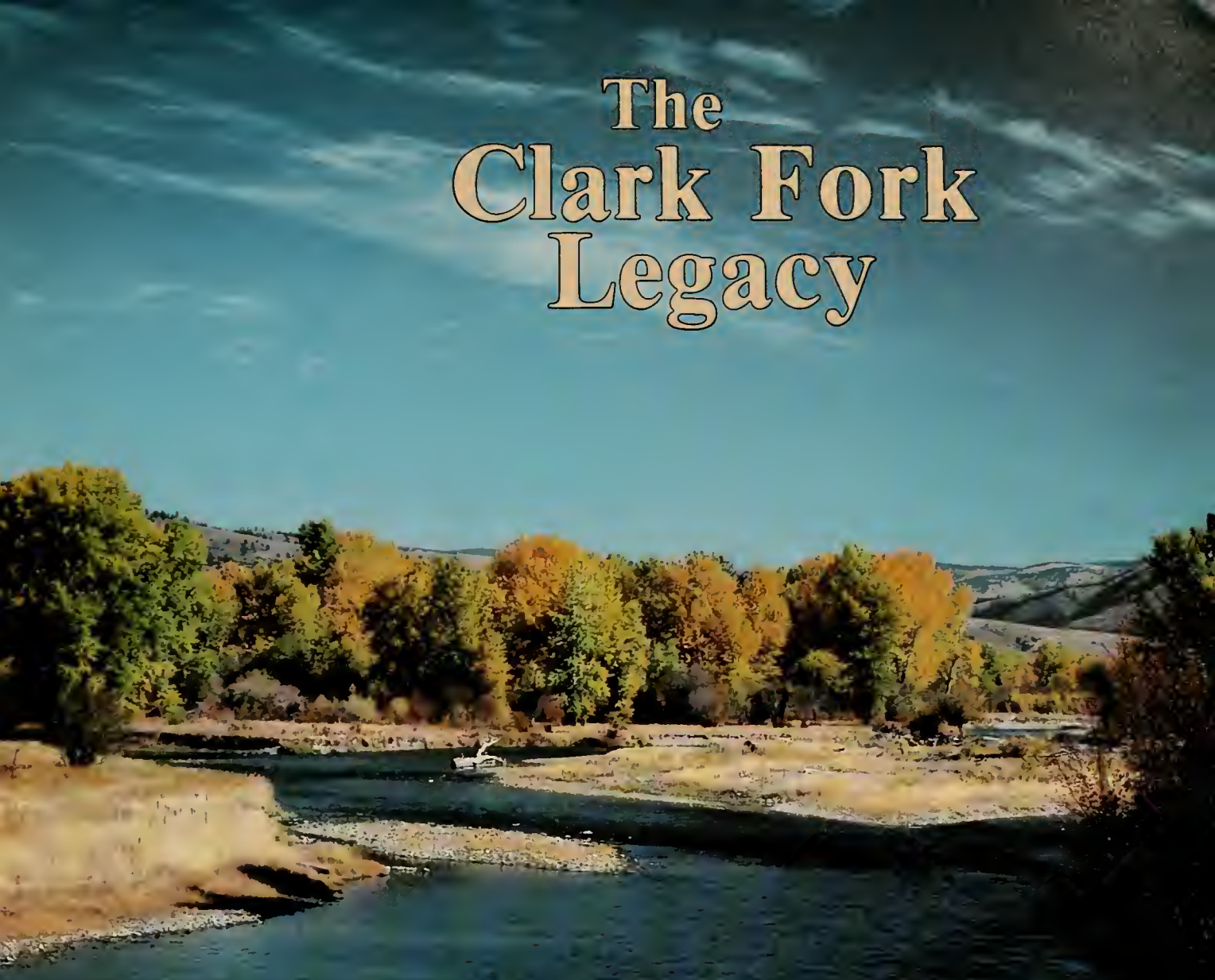
• Our second "Perspectives" (page 33) is "About Bluebirds" and their annual return to the Roy Larson farm near Conrad. Illustration was especially prepared for the piece by **Jan Bonham Metzmaker** of Whitefish, an artist new to our pages. Metzmaker spent 12 years working for the National Park Service in Glacier National Park and for the Lolo National Forest. She holds a B.A. from Missouri University and an M.S. in environmental studies from UM. From her studio in Whitefish, she operates a card and calendar business which features ink drawings of Glacier's wildlife. Her work can be seen, by appointment, at 716 Edgewood; Whitefish, MT 59937 (406/862-7960).

• "Broodstock Management" is "Part of the Fisheries Challenge." **Thurston Dotson** emphasizes that "wild is best when it comes to Montana's trout waters," but when reproduction is nil, or insufficient, planting is often the means for providing good fishing. Dotson traces the evolution of broodstock management—from primitive beginnings to a disciplined science. He also explores the department's Yellowstone cutthroat, westslope cutthroat, and Arlee rainbow broodstocks. For a look at a program vitally important to meeting the challenges an expanding society demands from our fishery resources, turn to his article on page 34. Dotson is manager of the Yellowstone River Trout Hatchery at Big Timber.

* * * * *

• Special thanks to the following photographers: **Gary D. Holmes**, Lolo; **Louis M. Kis**, Kalispell; **Alan Nelson**, Great Falls; **Bill Schneider**, Helena; **Nels Thoreson**, Belt; and to **Vern Craig**, Helena, for the cartoons illustrating "Travel On, But Leave a Name Behind."

The Clark Fork Legacy



by Larry Peterman

Most of us like to think of ourselves as relatively independent—able to chart our own course, plot our own destiny. We find, however, that our future options are influenced by past events. As people and even societies begin to question where they are heading, they realize just how influential the past can be. The legacies we inherit are the opportunities or constraints which shape our future. Whether we consider ourselves beneficiaries or victims of a legacy depends on the nature of that legacy and our personal values.

One of the legacies which can shape the very fabric of a society is the type, extent, and condition of its natural resources. The fertility of the soil; abundant wildlife and timber; scenic vistas and recreational opportunities; mineral deposits; and clean air and water (or the lack thereof) influence what we are and what we can become.

In Montana, we are fortunate to have many outstanding natural resource treasures, and predecessors who had the foresight to preserve them for future generations. The creation of the National Forest and

Clark Fork River (photo: BILL SCHNEIDER)

National Park systems were early attempts by pioneer conservationists to establish a foothold for a conservation ethic in this country. Today, Montana has 10 national forests and two major national parks. The Wilderness Act and the Wild and Scenic Rivers Act took the conservation ethic one step further and preserved intact a few of the remaining pristine mountain areas and wild rivers. Today, Montana has four wild and scenic rivers (sections of the Middle, South, and North forks of the Flathead, and a section of the Missouri) and over a dozen wilderness areas.

Almost a quarter of a century ago, the Montana Legislature began considering legislation that would provide state protection for Montana's streams and rivers. The legislators passed laws to protect and maintain water quality and stream bank stability, and, more recently, to provide for adequate stream flows in our rivers. Today, Montana's rivers are the envy of the rest of the country.

The Montana Legislature also provided for establishment of the state park system. Today, there are over 300 state parks, recreation areas, historic monuments, and fishing access sites.

The Montana Constitution states that "the state and each person shall maintain and improve a clean and healthful environment in Montana for present and future generations." The authors of that document were vitally concerned with natural resource questions and what would or should be left for future generations. This philosophy is also evident in later legislative acts such as the Montana Water Use Act; the Yellowstone Moratorium; the Montana Environmental Policy Act; the Montana Resources Indemnity Trust Fund; the Major Facility Siting Act; the Mined Land Reclamation Act; the Coal Tax, Park, and Fishing Access Site Acquisition Programs; and others. Montana's natural resources—and future generations—clearly benefit from such efforts.

If we take a collective look at our natural resource legacy, however, we find some notable exceptions. There are places and things which have not stood up well under civilization's pressures, which have not been maintained in "a clean and healthful" manner, and ecosystems that were destroyed long before the word "ecosystem" was even coined.

The upper Clark Fork River is such a place. The headwaters of most of Montana's major rivers (such as the Yellowstone, Missouri, and Flathead) lie in unspoiled mountain valleys, national parks, or large wilderness areas. The Clark Fork is different. The Clark Fork's headwaters begin or flow through three hazardous waste sites: Silver Bow Creek and the Colorado tailings site near Butte, the Anaconda Smelter and Opportunity wastewater pond system, and Milltown Dam (see Glenn Phillips' article, "A Clark Fork Prognosis," *Montana Outdoors,* Nov./Dec. 1983).

GARY D. HOLMES

Protection of existing stream flows is crucial to the Clark Fork's continued recovery and to maintenance of a productive fishery.

The headwaters of the Clark Fork have endured over 100 years of intensive mining activity. Butte began life as a gold and silver "boom town" in 1864, similar to the towns of Marysville, Virginia City, Elkhorn, Bannack, and others in the Montana Territory. Unlike the typical mining town of that era, however, Butte did not become an overnight ghost town or fade into obscurity when the gold played out and Congress repealed the Sherman Silver Purchase Act.

The reason Butte and its sister city of Anaconda survived was copper. The mining of precious metals in the Butte Mining District had almost ceased by 1880. But there were rumors of large deposits of copper ore. Marcus Daly, an Irish miner who had the reputation of being able to "see beneath the ground," purchased the Anaconda mine at a time when other miners were anxious to unload their properties. His gamble paid off handsomely. Historians tell us the original Anaconda mine "contained the richest bodies of copper sulphate the world had ever seen." The Butte Mining District has been called "the richest hill on earth." In stark contrast to other mining towns, Butte and Anaconda became world leaders in copper production and mining technology.

For over 70 years, the Clark Fork River received the untreated effluent from one of the largest mining ventures on earth. The runoff from mine tailings and smelting activities has resulted in metallic and other wastes being deposited in the stream banks and on the floodplain as far down as Milltown Dam. These wastes have now become a dominant feature of the riparian (streamside) geology of the upper river. For much of this time, fish life in the upper Clark Fork was all but eliminated, and the river suffered from frequent and severe "red tides," the result of spills of untreated, acidic, metal-laden waters directly into the Clark Fork. Effects of these spills were felt as far downstream as Missoula. Surely those associated with the Clark Fork River at that time must have considered the river a victim of the copper legacy; the future of the upper

Clark Fork was indeed grim. Measurable signs of life were all but absent until the latter part of the 1950s.

The late Joe Brooks, noted outdoor writer and accomplished angler, was one of the few who showed interest in the upper Clark Fork River. More than 20 years ago, Joe took the time to write about a river that most others had simply written off. The article was called "River With a Past...and a Future," and it was written in a remarkably positive fashion. Let's look at what Joe had to say about the upper Clark Fork in 1964:

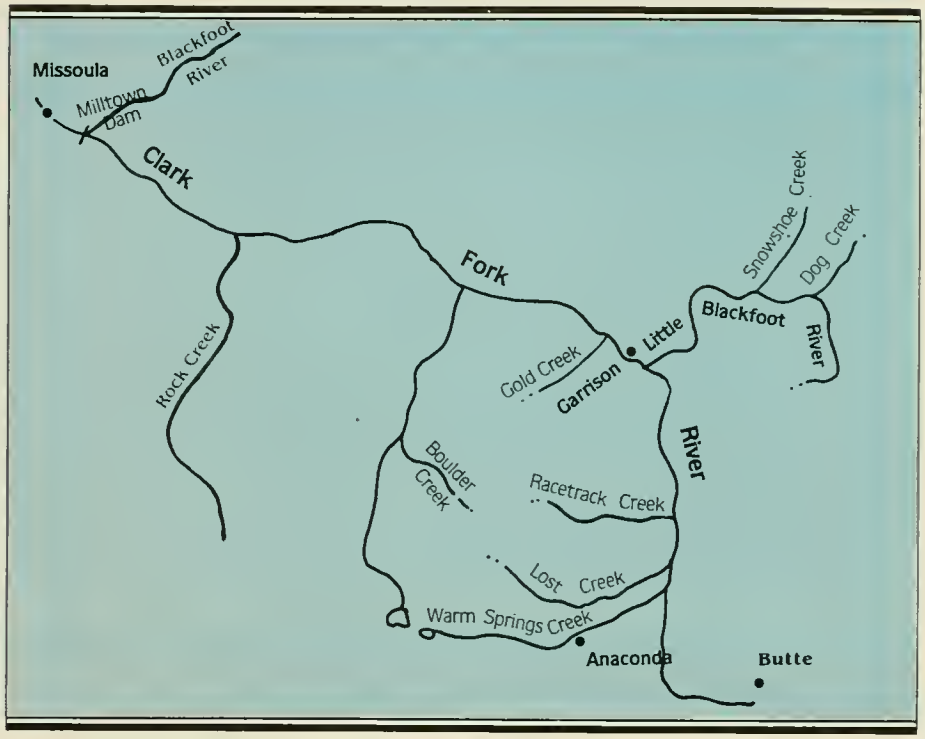
> Every summer for twelve years I'd driven along U.S. Highway 10 between Anaconda and Missoula, Montana, where it parallels the Clark Fork of the Columbia River—and I groaned loud and long. Here was a river whose waters ran over gravel beds that should have been alive with the nymphs that trout feed on. Here were undercut banks where lunker brownies should have lurked and white-water rapids where crimson-sided rainbows should have faced into the current. Here was mile after mile of what should be great fishing water, right by the roadside. But for twelve years I had never dropped a fly in that stream.
>
> Not a trout could live in the polluted water of the Clark Fork. Poisoned through half a century by waste dumped from the copper mines at Butte and the smelter at Anaconda, it was dead, officially designated by the Montana Water Pollution Control Council as late as 1955 as an "industrial river" unfit for use by the public.
>
> Suddenly I discovered that a river can come back to life. I was staying at Elliott's Rock Creek Lodge, twenty miles east of Missoula.... Bruce Elliott came to my cabin one morning as I was readying my gear for a trip up the creek. "Why don't you give the Clark Fork a whirl today?" he asked.
>
> "...something has happened on this river. For the past four years a few local fishermen have been bringing in some fine fish from the Clark Fork....This summer I know of several browns that were taken as far up as Drummond. That's fifty miles upstream toward Anaconda, the source of the pollution that originally ruined the river...."

Joe fished the Clark Fork that day, and was duly impressed:

> ...To take fish like this from a river that had been dead for half a century or longer did seem like magic....

But it wasn't magic that helped the Clark Fork; it was a government which cared, people who cared, and an industry which cared.

> ...in 1956...the Anaconda Company began construction of a series of settling ponds and clarification pools.
>
> "We had just begun to cheer," Bruce [Elliott] went on, "when something happened that seemed a catastrophe at the time, but was a real good break because it brought the whole story out into the open."
>
> As the result of unusually heavy rains, one of the old tailings ponds at the mine dump broke loose and poured its sludge down the Silver Bow [Creek] and into the Clark Fork. It killed fish by the hundred—fish that most people didn't know were there. The sight of those dead trout floating down the river roused the anglers as nothing else could.



> With the weight of 2,800 members behind him, Bill Bush, president of the Western Montana Fish and Game Association, went to work. He talked to sportsmen, fly tyers, guides, ranchers, operators of motels and restaurants, owners of tackle shops, grocery stores, and garages—everyone who might be hurt by this new devastation of a potentially great trout stream. The fact that they never had realized the Clark Fork was beginning to hold such a head of trout made it worse. They would back Bill Bush to the limit. With the promise of their support, he threatened to sue the Anaconda Company to show cause why it should not take steps to avoid such a thing happening again.
>
> He didn't have to sue. Setting an example that might well serve as a pattern for mining, lumbering, and industrial plants throughout the country, the Anaconda Company wholeheartedly tackled the problem. Working through W.A. Emmanuel, an Anaconda metallurgical engineer and a keen angler, company officials got together with sportsmen and plotted the future of the Clark Fork.
>
> Additional dikes were constructed, and an area of 4,000 acres was impounded to stabilize the tailings dumps so that another overflow could not occur. Filtering pools were improved, and the addition of lime to the water debouched from the ponds further neutralized the water....

After several days of fishing on the Clark Fork, Joe ended the article with these words:

> I straightened up and took one last look at this river that had been dead and was alive again. The stream is lovely now, running through beautiful country where rounded hills rise up from fragrant hay meadows and the slopes are covered with ponderosa pine, red fir, and quaking aspen. It's again the river it used to be—reborn of the dreams of a few anglers and conservationists and the cooperation of a large industrial company.

The article was written from the perspective of 20 years ago. At that time, trout in the upper Clark Fork were a miracle, a quantum leap forward from the conditions that had existed for the past half century. Even then, not much thought was given to the possibility of trout above Drummond.

The actors in the drama unfolding in the 1950s and early '60s built the first several rungs on the ladder to recovery for the Clark Fork River. Since then, several more rungs have been added. In 1972, the Anaconda Company installed a primary wastewater treatment and control system for the Butte facility. A secondary treatment system was installed in 1975. Again, the health of the Clark Fork took a few steps upward. Now, fish inhabit the upper Clark Fork all the way to the Warm Springs ponds near Anaconda. In fact, some of the best trout populations in the entire Clark Fork now exist in the uppermost reach near Warm Springs.

Fishery surveys by the Montana Department of Fish, Wildlife and Parks in a three-mile section of river below the confluence of Silver Bow and Warm Springs creeks reveal that this reach is capable of supporting 1,500 to 2,500 trout per mile, a density considered excellent for a stream this size. Like the ad says, "You've come a long way, baby!" But, as anyone familiar with the Clark Fork knows, there is still a long way to go.

The high trout density rapidly declines as one proceeds downstream. From Deer Lodge to Drummond, trout populations are only one-fourth to one-third of those in the upper reaches, due in large part to deteriorating water quality, dewatering, and a variety of habitat ills. The floodplain of the upper Clark Fork is laced with toxic mine tailings which periodically leach directly into the stream. Those areas with poor riparian vegetation to hold the stream bank in place contribute greatly to the problem. Fish populations continue to decline until the clear, cold waters of Rock Creek are added to the Clark Fork some 110 miles downstream from Anaconda.

The Clark Fork's recovery so far is neither complete nor long term. There is much room for enhancement of the fish populations in many reaches through improvements in water quality, stabilization of stream banks, and prevention of further dewatering in low flow years. The advances we are now experiencing depend on continued liming of Silver Bow Creek to maintain favorable pH (acidic) levels, a process successful only with man's continued assistance (see the Nov./Dec. 1983 article previously mentioned).

There are many rungs yet to be built on the Clark Fork ladder of recovery if we are to leave future generations a Clark Fork River in better shape than we found it. Mine tailings in the headwaters must be stabilized and/or removed. Silver Bow Creek still carries a large heavy metals load from leaching of existing mine tailings. Locally heavy rainfall produces freshets contaminated with heavy metals from tailings sites. These mini-flash floods can overwhelm the capacity of the Warm Springs liming ponds and discharge acidic, metal-laden water directly into the Clark Fork. This can result in substantial fish kills; the latest occurred in August 1984. Loss of brown trout in the affected 10 or more miles of river is estimated to have been 1,400 per mile.

The Warm Springs settling ponds themselves function efficiently for only part of the year; during the winter, they are less than satisfactory. Their life expectancy has yet to be determined, but appears to be limited.

The floodplain from Butte downstream to Drummond is a major source of metals contamination to the river. Those tailings which have been deposited during the last 100 years are gradually finding their way back to the river when high flows begin to erode stream banks, when the river naturally migrates, and from heavy surface runoff. Deteriorated riparian vegetation causes stream bank instability which adds to the problem.

Portions of the upper Clark Fork and several of its major tributaries are impacted by dewatering. Should additional dewatering occur, fish populations could be seriously damaged during years of low flow. As stream flows decrease, the amount of suitable habitat for fish and aquatic insects on which fish feed is reduced. At low flows, water temperatures and dissolved oxygen concentrations may reach levels which inhibit growth. Water quality worsens at low flows due to a lack of dilution to assimilate wastes and other pollution.

Major efforts have been initiated on several fronts to identify and begin to tackle the significant problems still confronting the Clark Fork River. At

the forefront of this effort are several government programs with the ability to raise the Clark Fork reclamation effort another rung or two. The Comprehensive Environmental Response Compensation and Liability Act, commonly referred to as "Superfund," was passed by Congress with the goal of cleaning up hazardous waste sites. Three areas on the upper Clark Fork—Silver Bow Creek and the Colorado tailings, the Anaconda Smelter and Opportunity wastewater pond system, and Milltown Dam—have been identified as Superfund sites. Remedial investigations are under way at those sites.

Gov. Ted Schwinden has created the Clark Fork River Basin Study, an effort coordinated by his office to create an integrated and accessible basin-wide data base. This program will draw on all past and current research to shape future decisions in the basin. In addition, a 13-member Clark Fork Basin Advisory Council has been created by executive order to advise the governor on various aspects of the Clark Fork issue.

The 1985 Montana Legislature considered the Natural Resource Legacy Program. This program is dedicated to developing natural resources to benefit Montanans and to repairing, reclaiming, or mitigating environmental damage from past or future resource extraction. What better place to begin reclaiming than the upper Clark Fork Basin?

A key in the Clark Fork reclamation is protection of existing stream flows. Maintenance of instream flows will ensure that existing fishery and recreational values are maintained. All other things being equal, establishment of minimum stream flow protection will provide for the fishery's continued existence.

On the Clark Fork, however, there is more to it than that. It is important to remember that the aquatic resources of the Clark Fork exist at levels far below their potential. Although much publicity has been generated about the recent recovery of the river in its uppermost reach, fish populations in other downstream reaches are still poor. In many of these areas, habitat conditions are adequate, and the basic productivity of the watershed is good; yet, fish populations are far below what we would expect from a river this size. Water reservations will provide the opportunity for fish populations to realize their full potential once reclamation efforts are developed and implemented.

As part of the Clark Fork reclamation effort, the department is applying for a reservation of instream flows in the upper Clark Fork Basin to protect a portion of the existing stream flows from further depletion.

LARRY PETERMAN

A legacy from mining days, metallic wastes still line the stream banks and floodplain of the upper Clark Fork, although the last 30 years have seen vast improvements in the river's quality.

The reach under consideration extends from the headwaters of the Clark Fork at the confluence of Silver Bow and Warm Springs creeks downstream to Milltown Dam. Major tributaries include: Warm Springs Creek; Lost Creek; Racetrack and Dempsey creeks; the Little Blackfoot River; Gold Creek; Flint Creek; and Boulder Creek. The reservation does not include Rock Creek or the Big Blackfoot River. The mainstems of these rivers already have instream flow protection authorized by an act of the 1969 legislature.

We are, by no means, reserving water in all of the tributaries to the Clark Fork. Tributaries selected are the major tributaries based on (1) those supplying spawning and rearing areas for Clark Fork fish populations, and (2) those with substantial resident fisheries. The first point is critical because spawning areas in the

main Clark Fork are often limited. For several years after major spills, the streambed is unsuitable for spawning as gravels often become cemented. In addition, in all years, copper concentrations are above the upper limit for successful trout reproduction. Tributaries are essential for maintaining fish populations in the mainstem.

An instream flow reservation will identify a minimum flow level in the Clark Fork adequate to maintain fisheries habitat and recreational opportunities. It will serve to lessen impacts from pollution. It does not influence or affect existing water rights in any way. It simply prevents future water use from more seriously dewatering the stream. When you think about it, that's pretty important.

Water reservations are often thought of as useful only for fish and wildlife. This is just part of the picture. Water can be reserved for future consumptive uses, as well as for instream uses. Municipalities, government entities, and conservation districts can reserve water for future municipal, agricultural, or storage purposes. Water left instream also benefits more than just the fish. Existing water users are assured of being able to exercise their prior appropriative right if there are adequate stream flows to transport the water to their headgate. They are also assured of having a functional headgate or withdrawal system if adequate stream flows exist. Maintaining the dilution capabilities of the stream benefits water quality. Adequate stream flows benefit the entire river basin community.

Let's consider the recreational potential of the upper Clark Fork for a moment. A recent recreational survey of the upper Clark Fork Basin determined that fishing was the activity in which recreationists most often participated. The water quality of the upper Clark Fork played a significant role in this use. For instance, more than 60% of the summer recreational use occurred in sections from Rock Creek to Milltown and above Deer Lodge where prime fisheries and high-quality water prevail—even though these areas comprise only about one-third of the entire river. Prime fisheries and high-quality water seem to attract the bulk of recreational use.

The high-quality fishery areas of the Clark Fork drainage have the ability to attract and sustain a substantial recreational use. There is no reason why the entire upper Clark Fork could not provide comparable recreation. In times when our existing river resources are accommodating large amounts of use, the upper Clark Fork seems almost like a neglected resource. Through maintenance of stream flows and proper reclamation efforts, the upper Clark Fork should be able to shoulder its fair share of recreational use. Establishment of instream flow reservations and the ultimate reclamation of the upper Clark Fork can only benefit the people who use the river, the people who depend on the river, and the people who live along the river.

MIKE GURNETT

Fisheries surveys show excellent trout densities in the Clark Fork's uppermost reaches, but populations decline as one proceeds downriver to the confluence with Rock Creek.

We are, in a very real sense, determining the Clark Fork legacy we will leave to our children. We have the opportunity to add the next several rungs on the ladder of recovery. The citizens along the Clark Fork have organized and spoken out in defense of the river. Outdoor writers, following in Joe Brooks' footsteps, are again writing of the Clark Fork's fortunes, and misfortunes. The government and its leaders are rallying to its support. We have an unprecedented opportunity to heal the river. The Clark Fork is a river whose time has come. ■

• *"River With a Past...and a Future" appeared in the October 1964 issue of* Field & Stream. *We are grateful to* Field & Stream *and to Joe Brooks' widow, Mary Brooks, for permission to reprint excerpts from it.*—Ed.

ABOUT BLUEBIRDS

• The following item was sent to us by Ruby Sporleder, chairman of the Bird Committee for the Conrad Garden Club. As Mrs. Sporleder wrote in an introduction to the piece, "What could be more exciting and interesting than to learn that bluebirds, the symbols of happiness, come to this area year after year?" The story takes place on the Roy Larson farm not far from Conrad, and it is told in the words of Mrs. Joan Larson.—Ed.

* * * * *

One late winter day, one of my boys was restless with nothing to do. I encouraged him to build a birdhouse to set out in spring. He styled it like a miniature doghouse and painted it red. We set the house on a platform against the pasture fence, overlooking a coulee. It was away from trees and buildings, but plenty of native grass was available.

Little did we realize that we had a good setting for bluebirds. Early that spring, about the second week of March, we were pleasantly surprised to watch a pair of bluebirds settle in the house and later five small blue eggs were hatched. We were having a very dry season, so my son and I aided our new family by digging and stuffing worms into the entry of the birdhouse. The parents responded by feeding the worms to their young.

The little birds were soon ready for flying lessons; they lined up on the pasture fence, with the parents coaxing them off by flying past them with tidbits of food in their beaks. Shortly, the young birds were flying all around.

The original birdhouse was home to bluebird families for nine years. It remained on the original site, somewhat away from buildings and trees, yet next to pasture and grass. However, it suffered from weather. Finally, there was no choice but to remove the old house and set up a

JAN BONHAM METZMAKER

new one built specifically for bluebirds and provided by a member of our local garden club. The original house went to the dump.

Imagine our surprise that spring when our field crew reported the little house was once again occupied, although it was now perched on top of a heap of refuse. Another bluebird family was raised there, and use has continued for the past few years.

Not all bluebirds need a house, as we discovered. One day after work in the fields, my husband complained that a pair of bluebirds flew all around him and his old red pickup whenever he drove into our yard. We thought the birds were attracted to the oustide mirrors on the pickup. Day after day, this particular pair of birds waited for the old pickup to return. With curiosity, we watched the pair disappear one day under the hood of the pickup. We lifted the hood, and there on the wheel well was a fine nest, and in the center were five tiny blue eggs.

Now we were faced with a dilemma. My husband had no choice but to use the pickup, yet he didn't want to drive around with a bluebird nest under the hood. I took one of the unoccupied birdhouses, painted it bright red, and placed it on a stand next to our red garage where the parents seemed to spend a lot of time. I then parked the pickup right next to the spot where I set up the birdhouse and I transferred the nest to the birdhouse, while the parents watched. We left the pickup parked there and went into the house to watch what would happen.

The parents dashed under the hood of the pickup and then raced into the birdhouse to check the nest. Again and again, they flew back and forth from the pickup to the birdhouse. This went on for hours. By the next day, however, they seemed satisfied with their new house, and we drove the pickup away. The original eggs were destroyed by a nuisance bird, but the nest was cleaned and "restocked" with four eggs, which hatched a few weeks later. The following spring the same old red pickup was targeted as a favored nesting spot, but we hid it away in time.

My husband has observed bluebirds around our farm in open fields and next to native grass. The grass seems important to them. We have few nuisance birds to drive away the bluebirds; since many of our birdhouses are within view of our house, I am able to chase away some of the nuisance birds. There have been some casualties; however, each spring, some bluebirds stay. About the second week of October, the bluebirds leave, taking with them our enjoyment—until they return once again about the second week of March. ■

BROODSTOCK MANAGEMENT:

Part Of The Fisheries Challenge

by Thurston Dotson

Was that trout you caught a wild or a hatchery fish? If from a stream, it probably was wild. If from a lake, it could be either; but if it was caught from a man-made reservoir, there is a good chance it started life in a hatchery.

Wild is best when it comes to Montana's trout waters. Those with self-sustaining populations, including almost all trout streams, are not planted. But when reproduction is nil, or insufficient, planting is often the means for providing good fishing.

The Department of Fish, Wildlife and Parks annually requires nearly 6 million trout eggs. Recently, up to 1.5 million eggs a year have been taken from a wild spawning run developed by introducing rainbow trout from Lake DeSmet, Wyo., into Harrison Lake (Madison County). After rearing in a hatchery, fish from these eggs are planted into other lakes and reservoirs with potential for natural reproduction.

There is a degree of uncertainty in this egg source, because the run begins with the first sign of spring. It starts and stops as the spawning stream warms and cools, and severe weather could completely frustrate egg-taking.

Hatchery broodstocks are more dependable and save a lot of travel, but there are trade-offs. You can't keep fish in a hatchery without losing some of their wild characteristics. But even brood lakes are not a perfect answer. For as generations pass, the fish tend to become adapted to that particular lake environment and lose some of the genetic diversity that allows their survival in more diverse habitats.

Another solution is to keep the broodstock at a hatchery, maintaining genetic diversity by scientific broodstock management and minimizing loss of wild traits by periodically bringing in "new blood" from the wild.

Over the years, broodstock management has progressed to a disciplined science. The broodstock manager has at his disposal a fish health specialist to diagnose and treat fish disease. The latest information concerning diet and nutrition is used to maintain healthy, vigorous fish. An important aspect of brood management is experience: working with broodstock, learning their dos and don'ts, acquiring a "green"—or rather a "wet"—thumb. Many of the present husbandry practices have been developed and refined after making mistakes, often painful ones, when we have asked too much of broodstocks in the hatchery environment.

Probably the most important tool the broodstock manager can take advantage of is the recent advances in fish genetics. A breakthrough in this field is a biochemical technique called electrophoresis, a method for checking the genetic variability of fish populations. When this is performed by qualified biologists, the broodstock manager is advised whether or not inbreeding is occurring and advised about procedures for correcting genetic deficiencies.

Advances in other animal sciences

DAVE BOOKS

such as behavior, nutrition, and embryology are also employed by the brood manager to produce high-quality eggs.

With this brief background of general broodstock management, we can now discuss in more detail the broodstocks maintained by the department.

Basically, the department has three needs for hatchery trout. First is for fish that can survive in the wild, reproduce, and live long enough to grow large. These are for water where the department is trying to establish reproducing populations. Here, the approach is to make the introduction, perhaps over three years to build an age structure, then cease planting. When successful (and this is a matter of the introduced fishes having a wide span of genetic differences), those with the innate ability will survive and give rise to future generations which will fully populate the environment.

The second need is for a similar fish, again one with the least possible domestication, for lakes and reservoirs where there is some natural reproduction but not enough to provide the desired population level. Here, the wild population is supplemented with hatchery fish. But the trick is to find a hatchery strain with a genetic profile that is as compatible as possible with that of the resident trout so natural reproduction is not suppressed.

A third need is for planting lakes and reservoirs where there are no trout spawning areas. Trout fishing completely depends on hatchery fish. This is classical put-grow-take management. The fish should do well under hatchery conditions; when planted, they should grow fast, and hopefully live long enough to grow large. Economy—cost per pound in the creel—is important. In meeting this need, some wild traits—for example, ability to spawn naturally—may be sacrificed.

Yellowstone Cutthroat Broodstock

The Yellowstone cutthroat broodstock meets the first two of these needs. The Yellowstone cutthroat is a "fish of special concern" in Montana, because it is a native whose range is severely shrunken. When used for lake planting, it provides excellent fishing; when self-sustaining populations result, the future of this fish is more secure.

BILL SCHNEIDER

In many lakes and man-made reservoirs, hatchery-produced trout can provide fishing opportunities where they would not otherwise exist.

The initial brood introduction was in 1969 when 15 males and females were spawned at McBride Lake in Yellowstone National Park and the eggs returned to the Yellowstone cutthroat hatchery at Big Timber. Fish from these eggs were retained, and the McBride strain of Yellowstone cutthroat entered the broodstock inventory. (All trips into Yellowstone Park to collect eggs for broodstock development are made with the approval of the park superintendent and under the supervision of a park fishery biologist.)

The hatchery stock of McBride cutthroat first matured and spawned in 1972. Due to water and space limita-

tions, many of the eggs taken at Big Timber that year were shipped to other hatcheries for rearing and stocking. This was fortunate.

That same year, the adult broodstock experienced a severe disease outbreak that required elimination of the brood and sterilization of the hatchery. Uninfected fish were returned to Big Timber to continue the Yellowstone cutthroat brood, but three years' production was lost.

In 1975, eggs from the McBride strain were available again in large enough quantities to allow planting significant numbers of fish.

Performance of the McBride cutthroat after stocking has been excellent. It has a demonstrated long life span and will spawn successfully in environments with suitable spawning habitat. The McBride cutthroat will adapt to a wide variety of environments, and its management role is expanding into large lakes and reservoirs—for example, Hebgen Lake.

Electrophoretic analysis of the McBride cutthroat shows it to be a pure-strain Yellowstone cutthroat. So, in addition to its other attributes, this fish can be stocked in waters that require pure-strain Yellowstone for protection of a wild stock in connecting waters.

The McBride brood experienced another disease outbreak in 1976, bacterial kidney disease (BKD). Before 1976, BKD meant complete sterilization and restocking of a hatchery. Fortunately, an advance in fish medicine emerged. Dr. Bill Klontz at the University of Idaho began publishing papers describing a new treatment for BKD. This treatment used a drug, erythromycin, that is common in human and veterinary medicine. The treatment required injections of specified doses to adult fish and disinfection of the eggs to prevent transfer of the bacteria through the egg to the next generation.

For 18 months before spawning in 1980, fish over 1 year old were injected each 30 days until they matured and spawned. Since April 1980, BKD has not been found in the Yellowstone cutthroat brood. The McBride cutthroat brood is now a healthy stock ready to fulfill its role in the management of Montana's fisheries. Unlike the 1972 outbreak, production was not lost, and stocking actually expanded during the treatment period.

Because of water and space limitations at Big Timber, only three year-classes of brood can be held. Renovation under way will relieve many of the water and space restrictions.

The brood is managed to minimize loss of genetic diversity. The key is the selection of future brood fish. This is a complex procedure involving: (1) mass pooling of sperm, and often eggs, to increase the number of crosses, and (2) employment of random methods (that is, avoiding any deliberate choice) in selecting eggs and, in turn, fish for recruitment to the brood.

The genetic diversity of the brood has been annually monitored since 1976. Results reveal little change when compared with fish reared from eggs taken at McBride Lake.

Future plans for the McBride brood include maintaining the genetic quality and diversity of the hatchery brood as close to the wild stock as possible. Plans are to return to McBride Lake (dependent on National Park Service approval) in 1985, '86, and '87 to obtain eggs for crossing with the hatchery brood. Since the fish mature as 3-year-olds, the actual crossing will occur in 1988, '89 and '90. This sequence of introducing wild genetic material into the Yellowstone cutthroat brood will be repeated periodically.

When an adult female is spawned at McBride Lake, only a small fraction of her eggs is taken for department use. She can then continue upstream and contribute to the future of the lake population.

Westslope Cutthroat Broodstock

The department also maintains a broodstock of our other cutthroat trout subspecies—the westslope cutthroat, likewise a fish of special concern. The need is the same as for the Yellowstone cutthroat broodstock: maintaining wild characteristics is paramount. Unfortunately, the eggs used to start this stock were from too few fish to represent the range of genetic diversity. Over 20 years, the limited initial diversity has declined until it is necessary to start again, to rebuild the stock with wild fish.

In 1983 and 1984, westslope cutthroat were obtained from 17 northwestern Montana streams. At maturity, fish from the various streams will be crossed and their progeny will become the department's new westslope cutthroat broodstock. Pure westslope cutthroat from other streams will be obtained in the future and added to the brood. Each of these groups of pure-strain cutthroat is distinct, differing in its adaptation to the particular habitat from which taken. Each will make a valuable contribution to the new broodstock.

Breeding schemes have been developed to minimize loss of genetic traits in the new westslope brood. It will be monitored regularly by a geneticist at the University of Montana.

Recent information indicates that when westslope cutthroat are exposed to the annual cold-warm temperature cycle, they will produce eggs of higher quality than when they are held at a constant water temperature. A portion of the new broodstock at Murray Springs Trout Hatchery near Eureka has been transferred to Washoe Park Trout Hatchery in Anaconda where it can be exposed to the natural temperature cycle. The ultimate home of the westslope cutthroat will depend on the quality of eggs produced and the response of the fish after being held and spawned at the Anaconda hatchery.

Arlee Rainbow Broodstock

Our Arlee rainbow broodstock fills the third of the department's needs for hatchery fish—that is, rainbows for planting lakes and reservoirs where there are no trout spawning areas and, in turn, there is little concern that hatchery fish might suppress a wild population.

This was the department's first broodstock. Its parental stock was acquired with purchase of the Jocko River Trout Hatchery at Arlee in 1945. The original fish at Arlee was from the Donaldson stock at the University of Washington. In 1955, eggs from a Missouri strain rainbow were fertilized with males from the Donaldson stock and the Arlee rainbow was born.

The Arlee rainbow quickly earned a reputation as a fast growing fish liked by anglers and sought by other states and agencies. This fish has been used almost exclusively for managing large lakes and reservoirs for the past quarter century—with some spec-

tacular successes, and a few less than spectacular.

Wild rainbows are spring spawners. Through selective breeding, the Arlee rainbow was adapted to spawn in the fall. As a result, limited spawning and recruitment are realized from it after stocking. This is a minor consequence, however, in lakes and reservoirs with little or no spawning habitat but with an otherwise excellent environment for trout. Another criticism of the Arlee rainbow is its apparent short life span after stocking. But to the angler who can catch a 3-year-old fish up to three pounds, the age of that fish is probably of little concern.

The fortunate crossing of the Missouri and Donaldson strain rainbows gave us a fish with a broad genetic diversity. Retaining this valuable quality is important to the department's fisheries management programs.

Arlee rainbow females are first spawned when they are 3 years old. Adult females are kept and spawned each year through age 4, and when additional eggs are needed, through age 5. Their eggs are fertilized with sperm from 2- and 3-year-old males. This breeding scheme reduces the chance of inbreeding by preventing full- and practically eliminating half-sibling matings. Also, the year-class crossings permit the flow of genetic material through the entire brood population.

Because of the heavy dependence on the Arlee rainbow for fisheries management, a large variety of sizes of fingerlings is required through the year. Several methods and techniques are employed to satisfy this demand.

Arlee broodstock has two spawning populations, regular and early. The regular Arlee rainbows spawn from mid-October through mid-January. Their spawning time is kept constant by stratified sampling of eggs for future brood fish. An equal number is randomly taken each week during the spawning period. Eggs from these fish can provide fingerlings in the four- to six-inch class for early spring stocking. The early maturing fish were acquired by keeping for brood recruitment large numbers of eggs from the first groups of fish to spawn. This technique has gradually advanced the start of spawning to mid-August. These eggs

DFWP PHOTO

Thurston Dolson, manager of the Yellowstone River Trout Hatchery, holds a 7.7-lb., 4-year-old McBride cutthroat—part of the department's Yellowstone cutthroat broodstock.

provide catchable-sized rainbow (7 inches and larger) when needed for spring plants.

Since water temperature is a factor in the maturation cycle, it also influences the rate of embryo development. In the past, several hundred thousand eggs from the later (regular) spawning brood are taken to the Anaconda hatchery. This hatchery has access to both spring water at 48 °F and creek water that drops into the low 30s. The late eggs from Arlee are incubated at a selected water temperature by mixing creek and spring water. This process slows the rate of embryo development and delays hatching to early spring. By selecting rearing stations with varying water temperatures, coordinated with the early-, late-, and delayed-development eggs, a custom-grown fish to meet management needs is now a reality.

Because of the desirable traits of the Arlee brood, any attempt to alter it is approached with extreme caution. Some test crosses have been made between Arlee rainbows and Eagle Lake rainbows.

Eagle Lake rainbows originally came from Eagle Lake in California. They are characterized as long-lived and piscivorous (fish eating). A hatchery brood of this strain is held at the Creston National Fish Hatchery at Creston, Mont. They start spawning in late December. Late-maturing Arlee females were crossed with early-maturing Eagle Lake males to produce the test crosses.

Offspring from these crosses are being evaluated to see if they add the desired traits of greater longevity and reproductive capability after stocking. If these test crossings add the desired traits without substantially altering its present characteristics, a new Arlee rainbow brood may emerge.

Another approach to reinstilling desired wild traits into the Arlee rainbow would be to cross it with Montana's native rainbow trout, a remnant of which still persists in the Kootenai River drainage. This idea is only in the preliminary planning stages and must be carefully considered before a decision is made to try it.

The sportsmen of Montana can be assured that any alteration of the Arlee rainbow will be accomplished only after careful evaluation. Any permanent changes will be made only after the crosses demonstrate that they add desirable traits, not merely change the Arlee rainbow.

As the demands on Montana's fisheries resource increase, new strains or species of fish may be required. in response to needs of the fish management biologist, broodstocks in the hatchery system will change to meet the challenge. However, experience has taught one thing: We will make sure replacement broodstocks demonstrate the needed traits before retiring their predecessors.

The management of Montana's fishery resources is a team effort. One member of the team is the biologist who recommends the management courses for a particular water. When stocking is prescribed, the other member—the hatchery system—comes into play. As in all successful team efforts, neither member functions well without the other.

The dynamic team of professionals—management biologists and fish culturists—is constantly refining techniques and testing new ideas, including strain performance and stocking times and sizes to obtain maximum utilization of hatchery-produced fish. Our fisheries team is prepared to meet the challenge that an expanding society demands from our fishery resources. ■

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